

# CONCRETE

## AND

### CONSTRUCTIONAL ENGINEERING

INCLUDING PRESTRESSED CONCRETE

MAY, 1953.



Vol. XLVIII, No. 5

FORTY-EIGHTH YEAR OF PUBLICATION

PRICE 1s. 6d.

ANNUAL SUBSCRIPTION 18s., POST FREE. 33-00 in Canada and U.S.A.

#### LEADING CONTENTS

	PAGE
Building Research . . . . .	163
Prestressed Precast Concrete Footbridges. <i>By N. A. Dews</i> .	165
Extension of the Dorchester Hotel, London . . . . .	169
Gap-graded Aggregates. <i>By J. D. O'Keefe</i> . . . . .	173
A Large Gasholder Tank . . . . .	179
Precast Buildings in Eire . . . . .	187
Thin Concrete Walls and Roofs . . . . .	189
Book Reviews . . . . .	191
A Composite Tee-beam Floor . . . . .	193

No. 546.

ISSUED MONTHLY

Registered for  
Canadian Magazine Post

#### BOOKS ON CONCRETE

For catalogue of "Concrete Series" books on concrete and allied subjects, send a postcard to:

CONCRETE PUBLICATIONS LTD., 14 DARTMOUTH ST., LONDON, S.W.1



*For over 60 years*

this trade mark has stood for speed and  
strength in reinforced concrete work.

# DRAGON

(Brand)

## PORTLAND CEMENT

*Supplied by*

THE SOUTH WALES PORTLAND CEMENT & LIME CO. LTD.  
PENARTH, SOUTH WALES

Telephone : Penarth 300

Telegrams : "Cement, Penarth"

# Burton's

## TUBULAR STEEL TRENCH STRUTS

(ADJUSTABLE)



REGISTERED



TRADE MARK



### OUTSTANDING ADVANTAGES

1.—Save at least 80% labour by eliminating the old-fashioned system of cutting, wedging and nailing timber strutting; no waste of timber.

2.—Fixed by one man in one minute.

3.—Being steel complete, they are practically everlasting and can be used over and over again indefinitely.

4.—Take up very little store space and very compact for transport.

5.—No loose parts which can be lost, so they are always ready for work.

### IN THREE SIZES

Size No.	Length		Approx. Weight
	Closed	Expanded	
1.	1' 6"	2' 3"	14 lb.
2.	2' 4"	3' 6½"	19 lb.
3.	3' 4"	5' 6"	24 lb.

## Burton's Patent Solid Dropforged Steel Scaffolding Fittings

## THE LONDON & MIDLAND STEEL SCAFFOLDING CO., LTD.

ST. LUKE'S WORKS, OLD HILL, STAFFORDSHIRE

Telegrams: DUBELGRIP, CRADLEY HEATH.

Telephone: CRADLEY HEATH 6237/8

London Offices: BURWOOD HOUSE, CAXTON STREET, S.W.1

Telephone: Abbey 6483/4.

Telegrams: Dubelgrip, Sowest, London



FACTORY WORK IN COURSE OF CONSTRUCTION

# YORKSHIRE HENNEBIQUE

FERRO - CONCRETE SPECIALISTS  
SINCE 1904

HEAD OFFICE : VIADUCT WORKS, KIRKSTALL ROAD, LEEDS, 4

Telephone : Leeds 20687-8-9

Telegrams : Ferro, Leeds

BRANCH OFFICES : 30, WINCOLMLEE, HULL. Telephone : Hull 33501

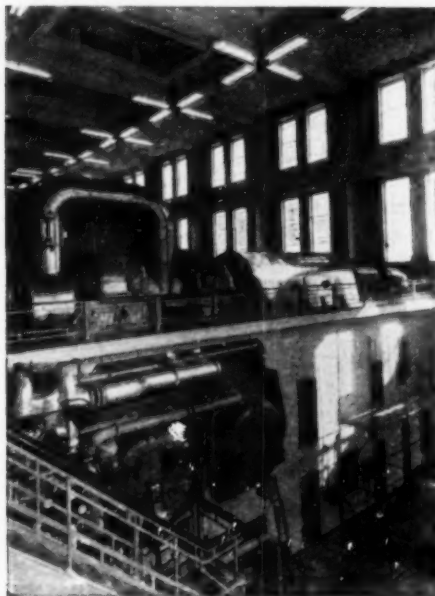
SCOTLAND : ALNESS, ROSS-SHIRE. Telephone : Alness 289

---





Plymouth 'B' Power Station is the first to come into operation of the three new stations now under construction in the South Western Division. *Consulting Engineers: L. G. MOUCHEL AND PARTNERS*



## CONTRACTORS FOR PLYMOUTH'S NEW POWER STATION

This £6½ million Power Station is one of the 50 new post-war power stations in the British Electricity Authority's construction programme. The site of about 15 acres is intended to provide for the future extension of the station to give an ultimate capacity of 180,000 kilowatts.

**LAING**

Contractors for every class of building and civil engineering work at home and overseas  
*John Laing and Son Limited. Established in 1848. London, Carlisle, Johannesburg, Lusaka*

# POWER BAR BENDERS

## FOR ALL SIZES OF REINFORCING BARS

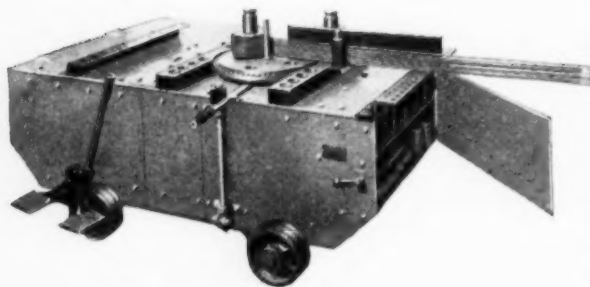
### STANDARD PRODUCTION MODELS

The ARD. 50 MODEL—as illustrated on right—has a capacity for cold bending Mild Steel Bars up to 2" dia. and incorporates a second Bending Head to give high-rate bending for small diameter bars.

The RAS. 40 MODEL shown below is a single disc machine of exceptional performance. With a capacity for 1½" dia. bars, it bends at highest practical rate—e.g. a full hook takes only 3 seconds bending time.



*Ensure accuracy, economy  
& simplicity of operation*



### INTERESTING FEATURES

Either of the Models illustrated can be supplied motorised or engine driven.

Standard Accessories supplied include all necessary Formers and Bending Pins, a special Backrest for simultaneous bending of a number of small diameter bars, and Accessories for forming right-angle loops in one operation.

Special Safety Device incorporated to prevent damage to mechanism if overloaded.

The desired Bending Angle may be set mathematically, and this is of great assistance in Repetition Bending.

# CEMENT & STEEL LTD.

SECOND AVENUE

CHATHAM

KENT

Telephone: Chatham 45580

Telegrams and Cables: Cembelgi, Chatham

Determining the cover of reinforcement, or the position of prestressing cables, immediately the concrete is placed avoids risk of unsafe structures . . .



The following is an extract from a letter received from a user of the C. & C.A. Covermeter regarding the illustration shown above—"I enclose a print of a reinforced concrete cantilever step that failed due to incorrect positioning of the reinforcing steel. Being one of a long double-flight staircase concern was felt for the safety of the other steps. The Covermeter was used, and they were all found to be unsafe in various degrees, necessitating cutting out and renewing. The new steps were checked by Covermeter before being built in."



## C. & C.A. COVERMETER

The Cement and Concrete Association Covermeter, illustrated above, has been specially produced to provide an easy, accurate, and economical means of finding the exact cover of reinforcement bars, or the position of prestressing cables, without interfering with the concrete and before the concrete has hardened. It thus enables Reinforced Concrete Engineers to make sure that the specified cover of reinforcement is maintained throughout the structure, and that the position of prestressing cables is in accordance with the design. It can also be used to find the position of reinforcement, gas pipes, and other fittings in existing structures. The C. & C.A. Covermeter can be supplied for Metric or Imperial systems of measurements. For full details and prices, send to the manufacturers:

**B. & P. RADIOS LIMITED**

(ELECTRONIC DIVISION), LANGHAM PARADE, LONDON, N.15. Tel.: Bowes Park 7140

# MAKE IT A FAST JOB WITH MILLFRAMES



Horizontal tube inserted in Millframe Coupler. Half-turn the spring steel plate, tighten bolt—it's fast!

Going up. The next Millframe slides quickly into position on verticals of the H-FRAME below.

Half-turn plate, tighten bolt. Millframes are then secured to give standard lift height of 6'.

Millframes of special light-gauge steel tube give high speed erection and dismantling.

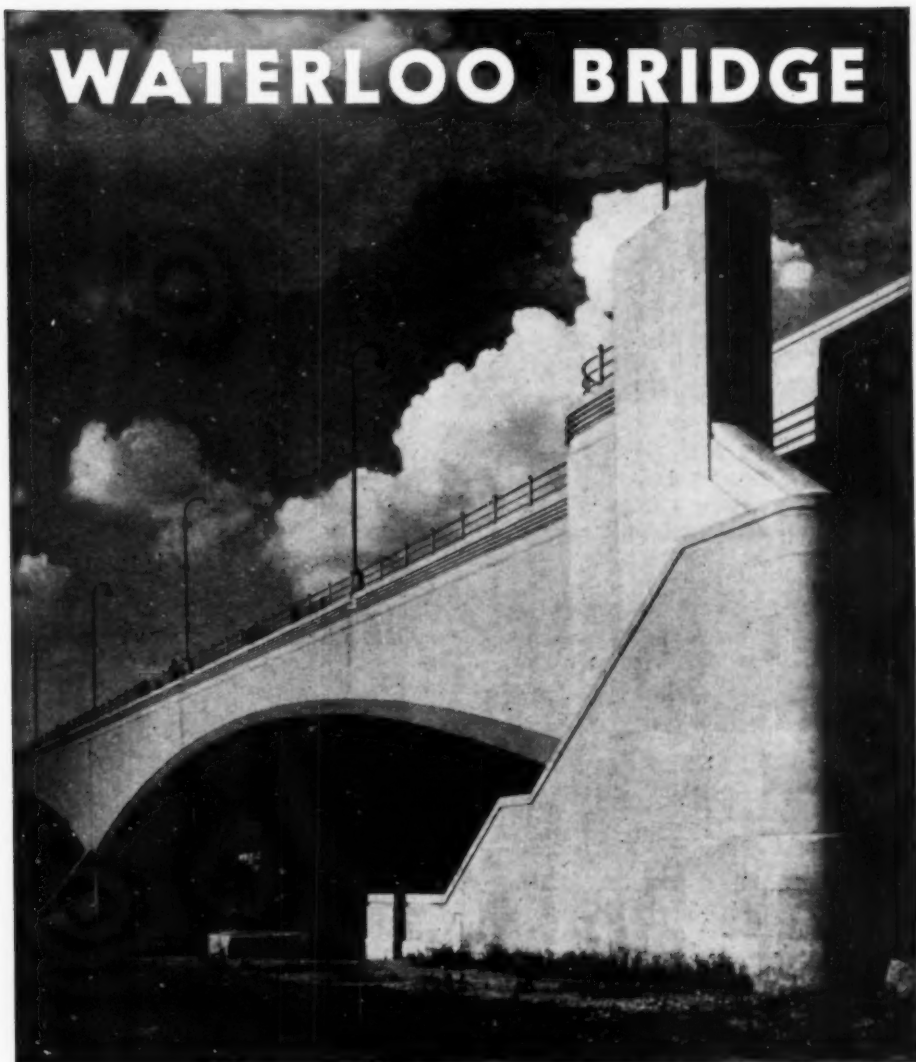
## MILLS SCAFFOLD CO. LTD.

(A Subsidiary of Guest, Keen and Nettlefolds, Ltd.)

Head Office: TRUSSLEY WORKS, HAMMERSMITH GROVE, LONDON, W.6. (RIVERside 5026/9)

Agents and Depots: BELFAST • BIRMINGHAM • BOURNEMOUTH • BRIGHTON • BRISTOL • CANTERBURY • CARDIFF  
COVENTRY • CROYDON • DUBLIN • GLASGOW • HULL • ILFORD • LIVERPOOL • LOWESTOFT • MANCHESTER  
NEWCASTLE • NORWICH • PLYMOUTH • PORTSMOUTH • READING • SHIPLEY • SOUTHAMPTON • SWANSEA • YARMOUTH

# WATERLOO BRIDGE



APPOINTED ARCHITECT  
SIR GILES GILBERT SCOTT, R.A.

APPOINTED ENGINEERS  
RENDEL, PALMER & TRITTON

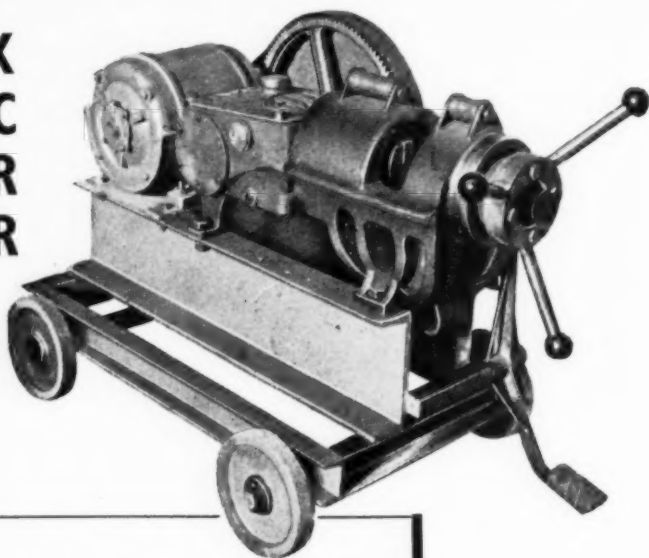
CHIEF ENGINEER TO THE COUNCIL  
SIR T. PEIRSON FRANK, M.INST.C.E.

## PETER LIND & CO LTD

STRATTON HOUSE, STRATTON STREET, PICCADILLY, W.1

TELEPHONE: GROSVENOR 4601

**"SOGEMAT"  
TRIPLEX  
HYDRAULIC  
BAR  
CROPPER**



**cheapest and  
most efficient  
bar cropper  
of its kind !**

This famous Belgian-made hydraulic bar-cropper cuts mild steel bars up to 1½ in. diameter, or an equivalent number of smaller bars, in a few seconds. The cuts are instantly controlled by a foot-pedal device, which leaves both hands of the operator free to handle the bars. The cutting jaws, made of special steel, are reversible, so that all four edges of the jaws can be used. It is easy to move, and is driven by a 5 h.p. electric motor. Let us send you full details of this low-priced machine.

We also supply Power Bar-Benders ; all sizes of Electric, Pneumatic, and Petrol-Driven Internal Vibrators ; Concrete Distributors ; Vibro-Finishers ; Vibro Joint-Cutters ; Central Mixing Plants ; Vibrosoil Compactors ; Trench Compactors ; etc.

**COMPACTORS ENGINEERING CO. LTD.**

65 EFFRA ROAD • LONDON • S.W.2.

TELEPHONE : BRIXTON 4081



# COLLOIDAL CONCRETE MIXERS

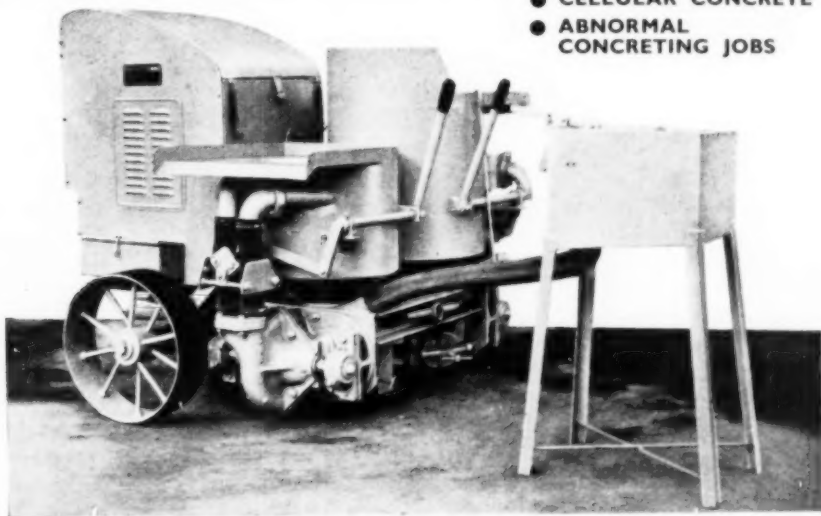
**T**hese machines make a water-cement-sand grout by high-speed mixing and pump it to the work through a rubber hose. The grout contains no chemical admixtures and is stable and fluent.

When the grout is poured on to the dry aggregate or to the bottom of inundated aggregate it completely fills the voids and makes a dense impervious concrete.

Compared with traditional concreting this method saves about 25% of cement and sand and reduces labour by requiring only 40% of the materials to be handled through the mixer.

for

- MASS WORK
- DAMS
- FOUNDATIONS
- FLAT WORK
- ROADS & AIRFIELDS
- FLOORS
- UNDERWATER WORK
- SEA DEFENCES
- DOCKS & HARBOURS
- GROUTING CABLE CHANNELS OF PRESTRESSED CONCRETE
- METALLIC CONCRETE
- CELLULAR CONCRETE
- ABNORMAL CONCRETING JOBS

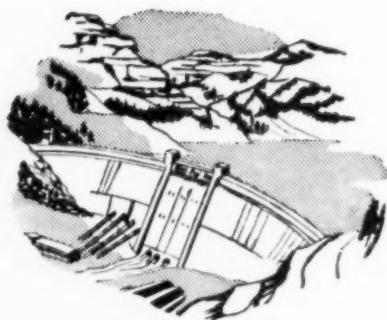


## COLCRETE LIMITED

GUN LANE • STROOD • KENT • Phone: Strood 7334 & 7736



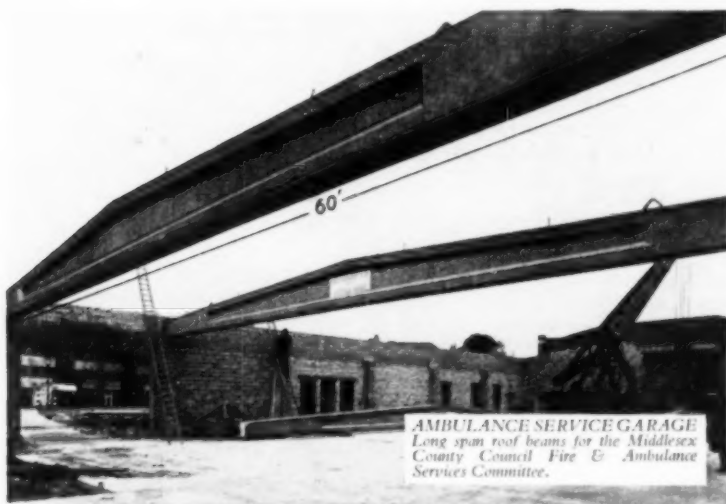
**If  
you've  
a  
WATER  
LEAKAGE  
problem**



The Cementation process is now being extensively used in sealing off leakages of water from large tanks, docks and other similar structures, and in rendering watertight tunnel linings. Contracts of this nature have been carried out for the South Metropolitan Gas Works, the Gas Light and Coke Co., the Meltham U.D.C. where escapes of water were occurring from the gasholder tanks, at the Burry Port Dock of the G.W.R. Barry Dock, and Leeds Electricity Works Canal, where loss of water through the walls and floors of the structure was becoming serious. Similarly, cementation has been employed in rendering watertight the swimming baths at Clifton, Bristol, and Bradford-on-Avon, and the sewage disposal tanks for the Doncaster Corporation. It has also been used for waterproofing of basement walls and floors as at the new B.B.C. House, London, Stockport Sewage Works, Grimsby Power Station, and for many other purposes.

**consult** *The* **CEMENTATION**  
COMPANY LIMITED

BENTLEY WORKS, DONCASTER. Telephone : DONCASTER 54177-8-9



County Architect: C. G. Stillman, Esq. F.R.I.B.A. Main Contractors: L. & W. Whitehead Ltd.



Prestressed precast units including floor and roof beams, long span saddle beams, bearing, sheet and fender piles. And in addition, precast concrete units covering a wide range including structural members, pole bases, duct covers.

*Prestressed Concrete saves steel  
Eliminates site shuttering  
Speeds up Construction · Reduces cost*

**CONCRETE DEVELOPMENT CO. LTD.**

*Prestressed Precast Concrete*

LONDON OFFICE: 54 WARWICK SQUARE, S.W.1. · PHONE: TATE GALLERY 0592  
OFFICE & WORKS: IVER, BUCKS · PHONE: IVER 809

# SUPER CEMENT

**'SUBMARINE BRAND'**

THE TANNO-CATALYSED PORTLAND CEMENT

**SAVES TIME**

**SAVES TROUBLE**

NATURALLY WATERPROOF, CONTAINS NO WATER REPELLENT MATERIAL

Uses:—

**For CONCRETE**

Provides a CONCRETE of great strength at early dates and impervious to water, oil, etc., without any form of surface coating.

**For PAVING**

Produces a hard wearing PAVING, dustless and proof against penetration by water, etc.

**For RENDERING**

Supplies an impenetrable RENDERING of such adhesive power that a 1" thickness will resist an outside pressure of at least a 20' head of water.

**For SLURRY (as paint)**

Makes a perfectly watertight covering to brick or breeze concrete walls at very small cost, and also provides the best watertight undercoat to coloured finishes.

Technical Information is available to users.

Used in 1914-1918 and still used by:

Air Ministry, War Office, Admiralty, Ministry of Works, Ministry of Supply, etc.

**SUPER CEMENT LTD.,**

29 TAVISTOCK SQUARE, Phone 1  
LONDON, W.C.1 Euston 1808

**CONCRETE  
PROOFING  
Co. LTD.**

**GUNITE  
SPECIALISTS**

Expert advice and schemes submitted for gunite work of every kind. Complete information on the various uses of gunite will be gladly sent on request.

96, Victoria Street, Westminster, S.W.1

Telephone:  
VICTORIA 7877 and 6275

**STABILITY**

**WIRE**

*for prestressed concrete*

**RYLANDS BROTHERS LIMITED**  
*of Warrington*

- **Reinforced Concrete**

DESIGN AND CONSTRUCTION

- **Floors**

IN SITU, AND PRECAST

- **Staircases**

- **Cast Stone**

- **Granolithic Pavings**

- **Duromit Pavings**

(In association with the Kleine Co. Ltd.)

# **STUART'S**

## **GRANOLITHIC CO. LTD.**

FOUNDED 1840

### **LONDON**

105 Baker Street, W.1.

Telephone: Welbeck 2525/6.

### **BIRMINGHAM**

Northcote Road, Stechford.

Telephone: Stechford 3631/2.

### **EDINBURGH**

46 Duff Street.

Telephone: Edinburgh 61503.

### **MANCHESTER**

Ashton Road, Bredbury, Stockport.

Telephone: Woodley 2677/8.



Another triumph for

**RAPID METAL**  
*Formwork*

### GLEDEVON DAM, PERTHSHIRE

*goes up with maximum speed and efficiency—*

From these pictures of the Glendevon Dam it is very easy to see why the contractors specified RAPID METAL Formwork. It does a better job—and it does it easier, quicker, cheaper.

As work progresses the steel Shuttering will be raised without dismantling, until the Dam, towering 150 ft. high and with a 1,200 ft. span, is completed.

No wonder Civil Engineers, Architects and Contractors are saying —



**Authority:**  
*The Fife County Council*

**Contract:**  
*Glendevon Dam, Perthshire*

**Main Contractors:**  
*Holland & Hannen and Cubitts  
(Scotland) Ltd.*

**Consulting Engineers:**  
*J. and A. Leslie & Reid,  
Edinburgh*

*You are cordially invited to Stand No. 14, Section F, Royal Ulster Agricultural Society, Balmoral Show, The King's Hall, Belfast.*

You can depend on **RAPID METAL**  
*Formwork*

*Sole Patentees and Manufacturers:*

**RAPID METAL DEVELOPMENTS LTD • 209 Walsall Rd., Perry Barr, B'ham, 22b • Tel: Birchfields 6021**

## **Prestressed Concrete**

**KURT BILLIG**

M.Inst.C.E., M.I.Struct.E., M.Am.Soc.C.E., M.Inst.C.E.I.

During the past decade the use of prestressed concrete has developed rapidly, but until now there has been no general handbook on the subject. Professor Billig, who is now Director of the central Building Research Institute, Roorkee, provides in this book a survey of existing practice. Illustrated with photographs, tables and diagrams. 36s.

**Macmillan**

St. Martin's Street, London, W.C.2

## **WHY WASTE LABOUR HACKING FOR A PLASTER KEY! "CONTRASET"**

can be used, saving both time and money.  
The best Cement Retarder for either Steel  
or Wood Shuttering. Write for full details.

**ALLIED BUILDING COMMODITIES  
LITTLE ROYD  
HUDDERSFIELD**

Telephone: Huddersfield 2901

# **Sealocure** *cures concrete*

### **CONVENIENTLY**

Without the trouble of damping down—no wet sacks or sawdust necessary.

### **SCIENTIFICALLY**

Sealocure forms a film over the surface of the concrete, thereby retaining water essential to secure complete hydration.

### **EFFECTIVELY**

Considerably increases tensile and crushing strengths. Test figures substantiated by eminent Consultants.

### **SIMPLY**

Applied soon after the concrete has been placed. No further attention necessary, the Sealocure film disappearing when hydration complete.

*On Air Ministry Approved List, and being used by Leading Civil Engineering Contractors.*

# **Sealocure** **CONCRETE CURING LIQUID**

SEALOCURE PRODUCTS LTD.

ATLANTIC WORKS, HYTHE  
ROAD, LONDON, N.W.10

Tel.: LADbroke 0015 6/7.

\*Grams: "Exploiture, Wesphone, London."





# *use the* **A.B.** **SERVICE** **for concrete work**

---

---

---

---

---

## SHUTTER PANELS

All sizes and types

## ADJUSTABLE SHORES

for floor and beam support

## ADJUSTABLE CENTRE FORMS

for floor support

## SHUTTERLOCK WALING CLIPS

for bracing with scaffold tube and locking the panels together, eliminating nuts and bolts in shuttering. Tremendous saving in erecting and striking costs

## COLUMN CLAMPS : BEAM CLAMPS

## ROAD FORMS : TRENCH STRUTS

We also design and manufacture Steel Moulds for Floor Beams, Piles, Railway Sleepers and all other precast concrete products

*Let us solve your problems*

### **A. B. MOULD & CONSTRUCTION CO., LTD.**

92 WHITEHORSE ROAD

CROYDON

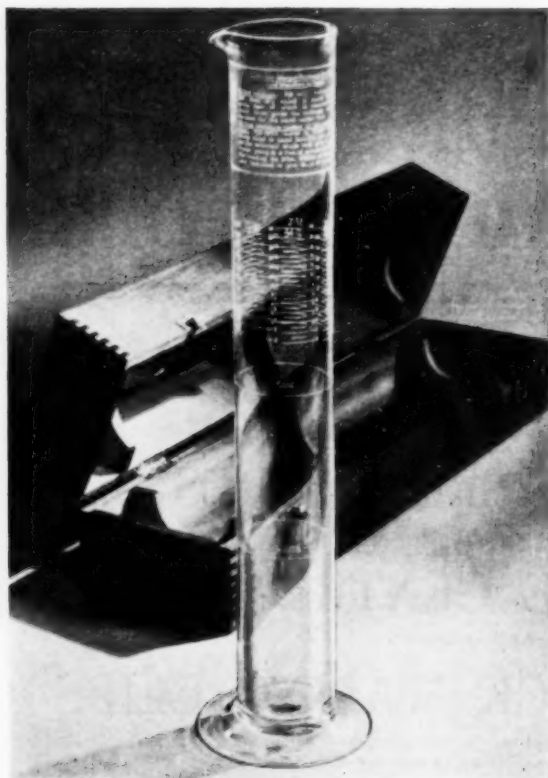
SURREY

Telephone : Thornton Heath 4947.

Telegrams : Abmould, Croydon.

WORKS: VULCAN WAY, NEW ADDINGTON, SURREY

# GAMMON-MORGAN WATER ESTIMATOR



PRICE £3 3. 0. each (9 Canadian or U.S. dollars)  
CARRYING CASE £1 11s. 6d. (4.62 Canadian or U.S. dollars)

## COLCRETE LTD.

GUN LANE, STROOD, ROCHESTER, KENT

TELEPHONE: STROOD 7334 and 7736. TELEGRAMS: GROUTCRETE, ROCHESTER

The most accurate, simple, and rapid means of measuring the water content in the sand. No weighing or chemicals are required, and an adequate sample is used. The GAMMON - MORGAN WATER ESTIMATOR should be available alongside every mixer, so that the water content of every mix may be correctly gauged. Full details will be sent on request.

### MOISTURE VARIATIONS IN THE SAND

★ Engineers should specify that the concrete mix shall be adjusted for moisture variation in the sand, so that the total water in the batch shall consist of the water carried in the aggregates plus the water added in the mixer.



# TELECRETE

## LIQUID CONCRETE TIPPER

**The  
ideal method  
of transporting  
concrete from  
a central  
mixing plant**

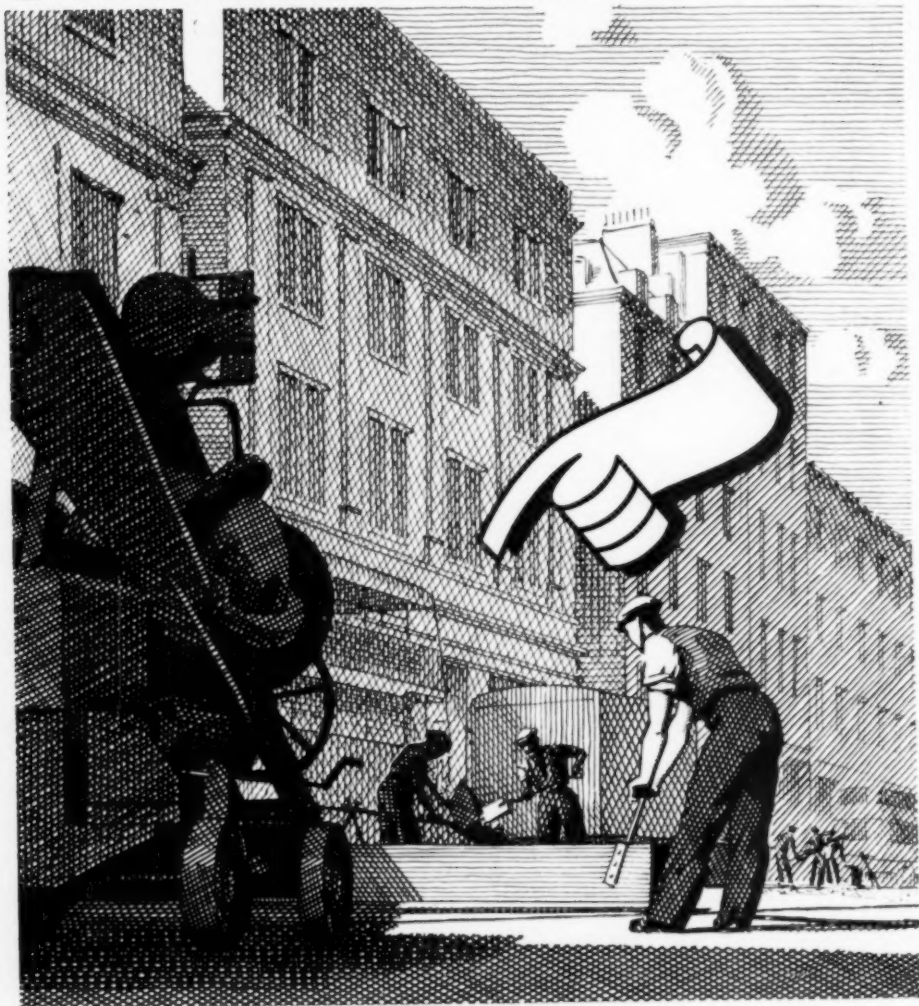


Designed specially for big contracts, the Telecrete Concrete Tipper has proved an economical factor in speeding up the handling of concrete, with savings in labour costs and time. It is sturdily constructed, easy to operate, and will withstand heavy wear and tear. Ideal for concrete roads, runways, sea walls, factories with large floor areas, and other contracts involving the use of large volumes of concrete. Let us send you full particulars.

Write for illustrated details:

## TELEHOIST LIMITED

TELEHOIST WORKS, Swindon Lane, CHELTENHAM, GLOS.  
TELEPHONE: Cheltenham 53254-5-6 and 55152. TELEGRAMS: Telehoist, Cheltenham.



Not by its fair surface but by its hidden strength is concrete to be judged. Here's why, increasingly, good specifications for road and airfield and building foundation call for an underlay of IBECO waterproof concreting paper. There's no better insurance for even hydration, sound setting, all-through strength, long life.

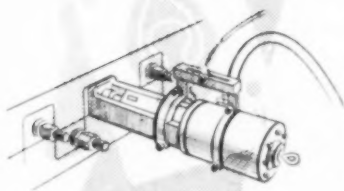


# IBECO

## COMPLETELY WATERPROOF CONCRETING PAPER

MADE BY C. DAVIDSON & SONS LTD · MUGIEMOSS · ABERDEENSHIRE

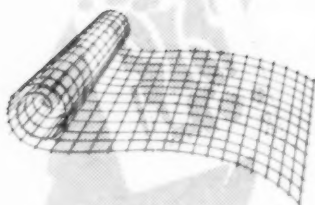
# 3 strong cards..



## "MACALLOY" BARS FOR USE WITH LEE-McCALL SYSTEM OF PRESTRESSED CONCRETE.

Working Stress of 95,000 p.s.i.

An economical and effective system of prestressing concrete, using high-tensile alloy steel in bar form. The steel is provided with positive end-anchorage and does not rely upon bond to transmit the stresses to the concrete.



## "MATOBAR" WELDED FABRIC REINFORCEMENT.

To B.S. 1221-1945, Part A. Working Stress of 27,000 p.s.i. Economical for all types of concrete construction. Hard drawn, high tensile steel wire mesh, electrically welded at every intersection.



## "ISTEG" STEEL REINFORCEMENT (MANUFACTURED UNDER LICENCE).

Twin Twisted Bars to B.S. 785-1938 and B.S. 1144-1943. Working Stress of 27,000 p.s.i.

Steel bars with a combination of twist and cold working, giving 50% improvement in tensile stress; 30% less weight of steel. Improved bond, hooks and overlappings eliminated.

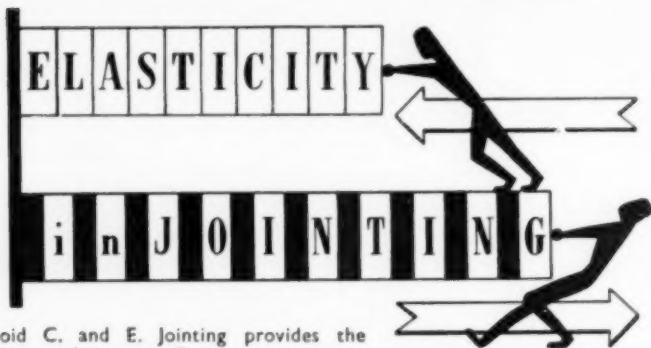
## INCREASED WORKING STRESSES.

The stress of 27,000 p.s.i. complies with C.P.114, but in certain circumstances these stresses may be increased to 30,000 p.s.i. if due care is taken in the design, thereby showing still greater steel economy as recommended in the Ministry of Works Steel Economy Bulletin No. 1.

REINFORCEMENT BY ..



**McCALL AND COMPANY (SHEFFIELD) LIMITED**  
TEMPLEBOROUGH, SHEFFIELD AND AT LONDON



Ruberoid C. and E. Jointing provides the necessary resilience to allow concrete structures of all types to move under temperature variations without building up dangerous stresses. Where a 'single operation' material is required Ruberoid C. and E. Jointing can be relied upon to give complete satisfaction. Available in lengths up to 6 ft., thicknesses from  $\frac{3}{8}$  to 1 in. and depth to suit the concrete. Use Ruberoid, the original Concreting Paper, in the road bed. It prevents absorption of liquid cement into the sub-base and aids free movement of the slab.

a product of:

THE RUBEROID COMPANY LTD.,

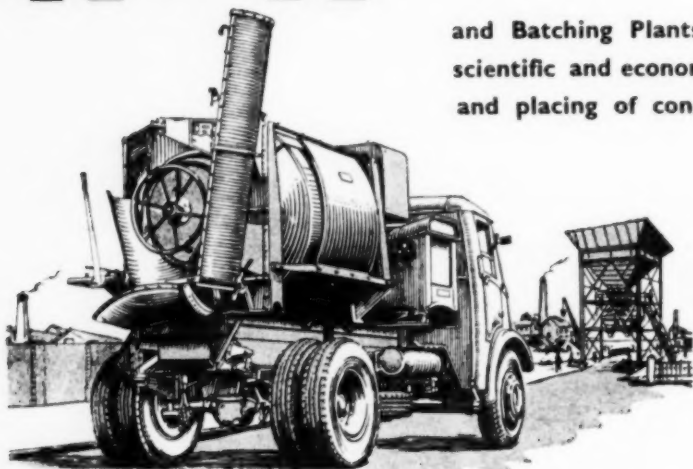
187, COMMONWEALTH HOUSE, NEW OXFORD STREET, LONDON, W.C.1



C.E.113

## RAPIER TRUCK MIXERS

and Batching Plants for  
scientific and economical mixing  
and placing of concrete.



Also makers of a full range of tilting, and non-tilting mixers and self-priming water pumps.

**RANSOMES & RAPIER LIMITED**  
IPSWICH—WATERSIDE WORKS. 32, VICTORIA ST., LONDON.



# KOPEX TUBES

for

★  
**PRESTRESSED CONCRETE**  
★

the new and  
better method of  
forming **CABLE DUCTS**

**WILL BEND TO ANY SHAPE AND REMAIN RIGID**

The use of KOPEX TUBES by Engineers and Contractors has already proved that they afford a simple means of forming cable ducts with unskilled labour and without fixing equipment for the most intricate prestressed concrete design. This new development in prestressed concrete work should be investigated by all Engineers and Contractors engaged in this class of work, to whom we will be pleased to submit samples and full details.

## UNI-TUBES LTD.

9 SOUTH MOLTON STREET, LONDON, W.1.

Telephone: MAYFAIR 7015.

WORKS: ALPHA STREET, SLOUGH.

Telephone: SLOUGH 24606.

---



... it's

# KWIKFORM

REGD. TRADE MARK

... Specialisation in  
concrete formwork

The Two-Component System  
... without equal for safety,  
speed of erection and dis-  
mantling. No other system  
can guarantee so little deflec-  
tion without propping.



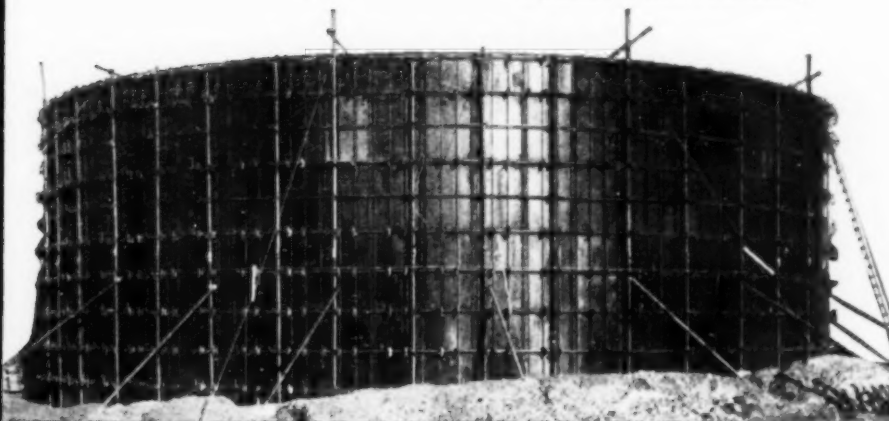
Shell Roof Construction is simpli-  
fied by the use of 'Kwikform'  
Flexible Formwork. Minimum  
constructional time — true clean  
soffit — maximum unobstructed  
working space — adaptability to  
any radius above 3 ft. — absolute  
rigidity of formwork.



The Adaptable Concrete Form-  
work. Designed for use in the  
widest possible range for double or  
single facework; columns; beams;  
piers; battered retaining walls, etc.



The illustration shows Flexible Formwork in position to receive reinforcing.



Circular Tank construction is simple, speedy and economical when Flexible Formwork is used. Illustration is by courtesy of Preload (G.B.) Ltd.

Descriptive literature of all 'Kwikform' equipment available on request. SALE or HIRE

Patents granted and pending in all principal countries of the world.

**KWIKFORM LTD.**

**KWIKFORM LTD., WATERLOO ROAD, BIRMINGHAM, 25.**

*London Office: 66 Victoria Street, S.W.1.*

... it's

# KWIKFORM

REGD. TRADE MARK

... Specialisation in  
concrete formwork

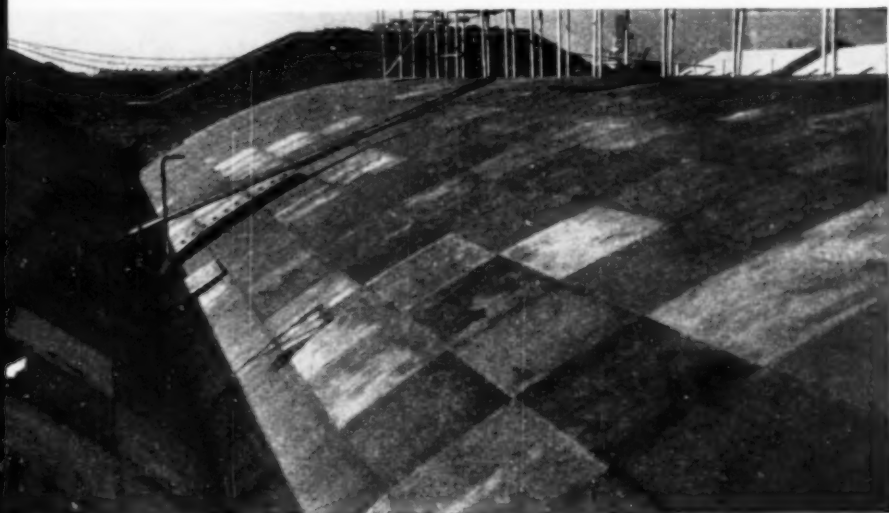
The Two-Component System  
... without equal for safety,  
speed of erection and dis-  
mantling. No other system  
can guarantee so little deflec-  
tion without propping.



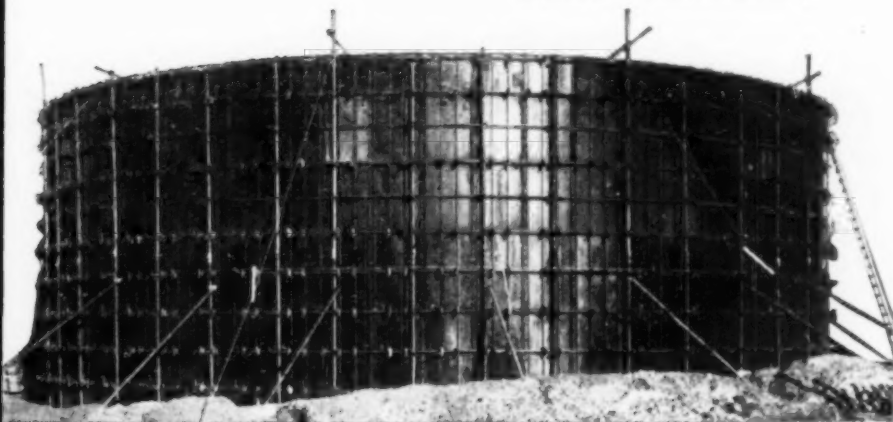
Shell Roof Construction is simpli-  
fied by the use of 'Kwikform'  
Flexible Formwork. Minimum  
constructional time — true clean  
soffit — maximum unobstructed  
working space — adaptability to  
any radius above 3 ft. — absolute  
rigidity of formwork.



The Adaptable Concrete Form-  
work. Designed for use in the  
widest possible range for double or  
single facework ; columns ; beams ;  
piers ; battered retaining walls, etc.



The illustration shows Flexible Formwork in position to receive reinforcing.



Circular Tank construction is simple, speedy and economical when Flexible Formwork is used. Illustration is by courtesy of Preload (G.B.) Ltd.

Descriptive literature of all 'Kwikform' equipment available on request. SALE or HIRE

Patents granted and pending in all principal countries of the world.

**KWIKFORM LTD.**

**KWIKFORM LTD., WATERLOO ROAD, BIRMINGHAM, 25.**

*London Office : 66 Victoria Street, S.W.1.*



# HUMDINGER VIBRATOR

HIGHER FREQUENCY - LOWER PLACING COSTS

Will deal easily with so called "no-slump" mixes, e.g., 1:2:4 mix, 0.5 water-cement ratio, or 1:1½:3 mix, 0.4 water-cement ratio. The Humdinger's 11,500 vibrations-per-minute compact quicker and can save money on every cubic yard of concrete placed. The co-axial positive drive gives a flexible shaft speed of only 2,500 r.p.m.—ensuring long, constant use between routine overhauls. Petrol motor (with centrifugal idling clutch), or electric drive. For all grades of concrete, use an ACE Humdinger. Please write for more information.



- Lowest cost per yard
- Better concrete
- Faster placing
- 10,000/12,000 v.p.m.



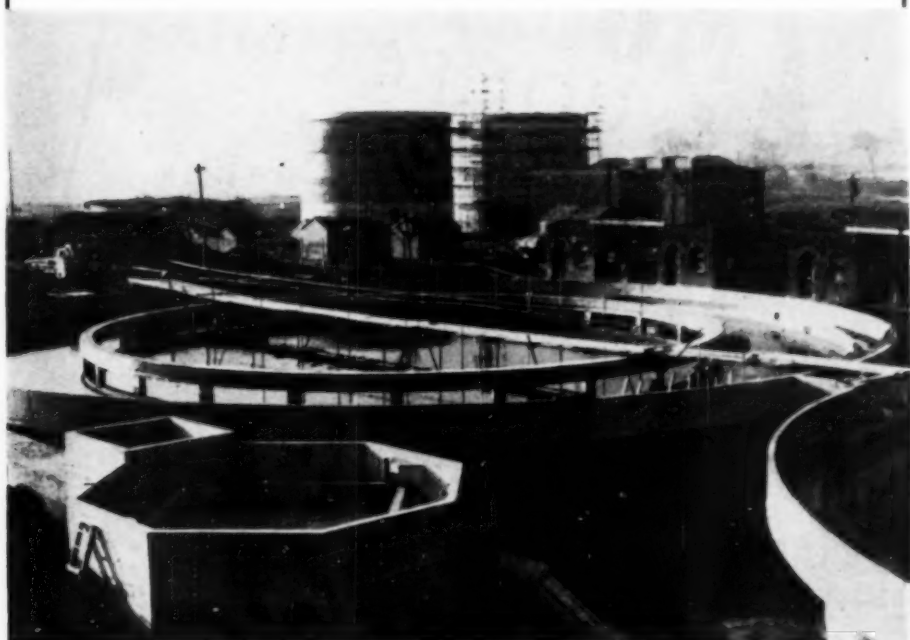
A.C.E. MACHINERY LTD.



VIBRATOR DEPT., PORDEN RD., BRIXTON, LONDON, S.W.2. Tel: BRixton 3293



# CHRISTIANI & NIELSEN



Extensions to Sewage Works for Burnley Corporation. Borough Engineer & Surveyor :  
A. G. Richardson, Esq., A.M.Inst.C.E., M.I.Mun.E.

**CHRISTIANI & NIELSEN LTD., 54 VICTORIA ST., LONDON, S.W.1**

*Telephone : Victoria 6152-5*

ALSO OFFICES AT: Aarhus — Asuncion — Bahia  
Bangkok — Buenos Aires — Cape Town — Caracas  
Copenhagen — Durban — Guayaquil — Hamburg  
Helsingfors — Lima — Lourenco Marques — Mexico City  
Montevideo — New York — Oslo — Paris — Rangoon  
Rio de Janeiro — Sao Paulo — Stockholm — The Hague



# MOULD OILS & COMPOUNDS

for every process of  
concrete production

## CONCREAM

This non-staining, smooth and easy working white mould oil can be used with confidence on all classes of in situ and precast concrete work where the use of a white mould oil is recommended.

## VIBRAMOL

This non-staining and non-separating mould oil is made specially for use on steel shuttering and moulds where vibrators are used, and provides a good film which is not readily moved under vibration.

## SPRAYMOL

This grade of mould oil has been specially produced for use with a spray gun. It can be used with great economy on all types of shuttering and moulds, and will not separate under pressure.

## "P.S."

Experience has shown that the production of precast and in situ prestressed concrete needs a special mould compound, and in collaboration with leading prestressed specialists we have produced Grade "P.S." Mould Compound for this class of work.

## "8.A."

This Mould Compound has been specially produced to satisfy the requirements of those engaged in the production of spun concrete products.

**CONCREAM** Regd.  
**VIBRAMOL** Regd.  
**SPRAYMOL** Regd.  
**"P.S." & "8.A."**

### PRODUCTS OF THE ORIGINAL MAKERS OF CONCRETE MOULD OILS

We specialise in the production of mould oils and compounds for concrete work of every kind, from mass concrete work to high-class architectural stone work, and have an unrivalled experience which enables us to give expert advice on all mould oil problems. We have a grade for every purpose, and will be pleased to submit full details, samples, and prices on request.

**RICH<sup>d</sup> HUMBLE & SON, LTD., COLUMBA OIL WORKS, LEEDS, 3**

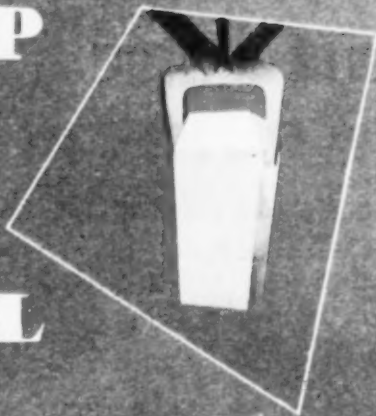
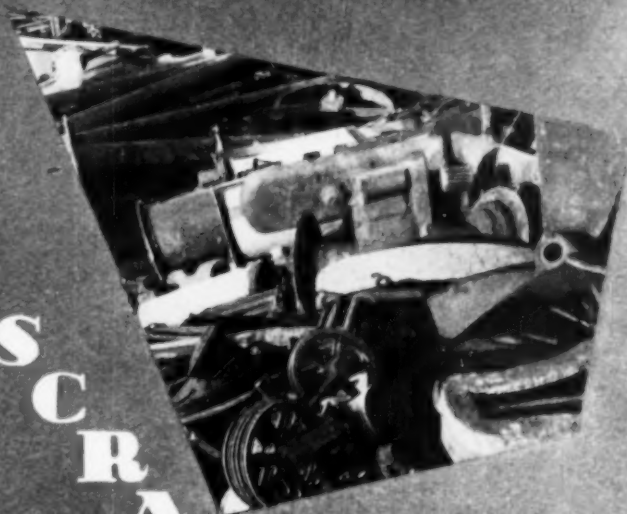
Telephone : 27155.

ESTABLISHED 1854.


Telegrams : "Columba, Leeds, 3."



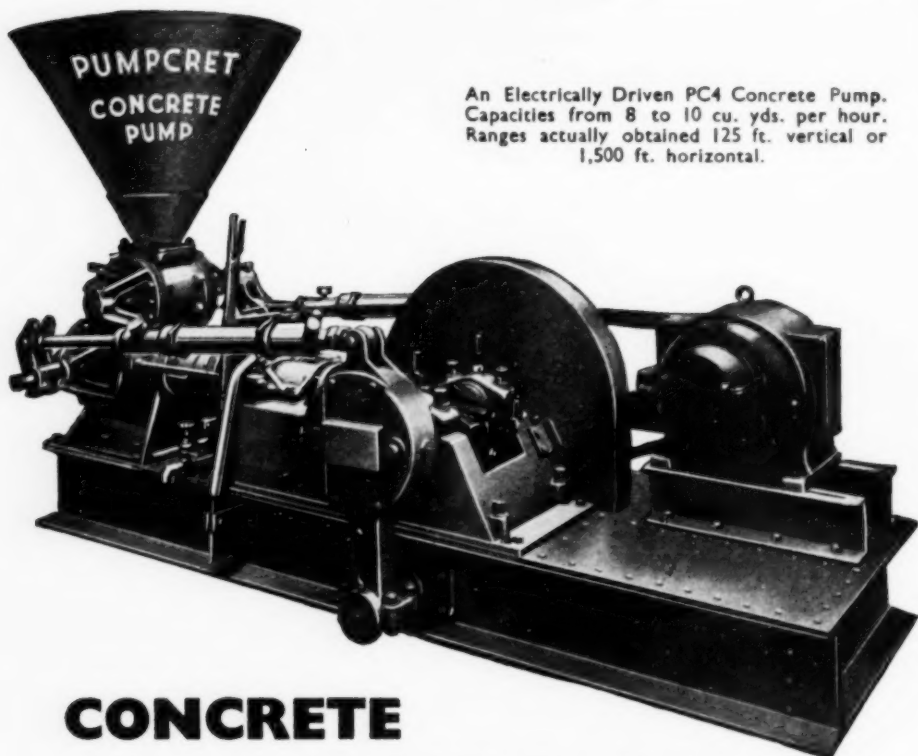
NO  
NO  
SCRAP  
STEEL



●  
SEARCH OUT *YOUR* SCRAP  
& OBSOLETE PLANT *TO-DAY!*

 **COLVILLES**   
LTD

COLVILLES LTD 195 WEST GEORGE STREET GLASGOW C.2



An Electrically Driven PC4 Concrete Pump.  
Capacities from 8 to 10 cu. yds. per hour.  
Ranges actually obtained 125 ft. vertical or  
1,500 ft. horizontal.

## CONCRETE BY PUMP AND PIPELINE

- The latest and most efficient method of placing concrete.
- Pump and Mixing plant can be located where it is most convenient for storing and handling aggregates and cement.
- The concrete is delivered by pipeline just wherever it is required with the minimum of interference with the building operations.
- The speed of the pump governs the whole of the concreting gang.
- Pumpable concrete must of necessity be good concrete.

### THE CONCRETE PUMP COMPANY LTD

4 STAFFORD TERRACE, LONDON, W.8

Telephone: Western 3546.

Telegrams: Pumpcret, Kens, London.

# DOUGLAS

**builds** *from first to last*

Here is yet another in a long succession of DOUGLAS contracts completed smoothly and on time—thanks to constant teamwork, craftsmanship and efficiency.

ROBERT M. DOUGLAS (CONTRACTORS) LTD.,

395, George Road, Birmingham, 23.  
Bridge Road, Waunarlwydd, Swansea.

*The New Main Facade for the British Industries Fair at Castle Bromwich, Birmingham, constructed for the Birmingham Chamber of Commerce. Architects: Harry W. Weedon, F.R.I.B.A., and Partners.*



- CIVIL ENGINEERING · BUILDING · SITE INVESTIGATION · EXCAVATIONS  
FOUNDATIONS · REINFORCED AND PRESTRESSED CONCRETE · FACTORIES  
ROADS · BRIDGES · PILING · SEWERAGE · RAILWAYS · WATERWAYS · TUNNELS

# GLASCRETE for SHELL ROOFS

Shell roofs can be efficiently lighted by simply placing precast GLASCRETE panels on the shuttering and casting in monolithic with the roof, thus saving time and labour in trimming openings.

Panels are cast to the curve of the roof and anchor bars are left protruding from the frame for bonding to the roof slab.



Factory, London.

Architects: Messrs. Clifford Tee & Gale.

Telephone: CEN. 5866  
(5 lines)

**J. A. KING & Co. LTD.,**  
181, QUEEN VICTORIA ST., LONDON, E.C.4.



**PIN YOUR FAITH  
TO THE TESTED  
BRAND.**

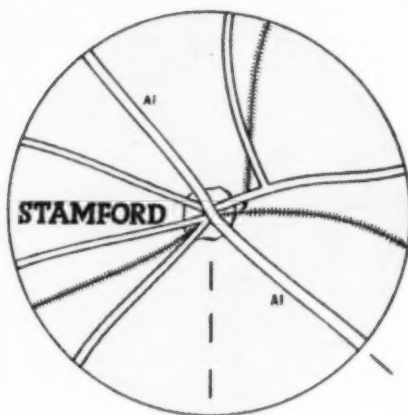
THIS LABEL ON  
EVERY BARREL  
CARRIES WITH IT  
FORTY YEARS'  
EXPERIENCE OF  
MANUFACTURE.

**NONE OTHER IS  
"JUST AS GOOD"**

**THE LEEDS OIL & GREASE CO.**  
LEEDS, 10

Phone 22480

'Grams: "Grease."



## ANOTHER ANGLIAN PRESTRESSED PRODUCT

Prestressed concrete beams in use on the partly-completed road-over-rail bridge on the Great North Road at Stamford. This illustration shows one of several trunk road bridges at present under construction using "ANGLIAN" prestressed beams.

*Photograph by courtesy of  
British Railways, Eastern  
Region. Contractors:  
Messrs. Wellerman  
Bros. Ltd., Sheffield*

**PYLONS**

**PILES**

**SHEET PILES**

**ROAD AND**

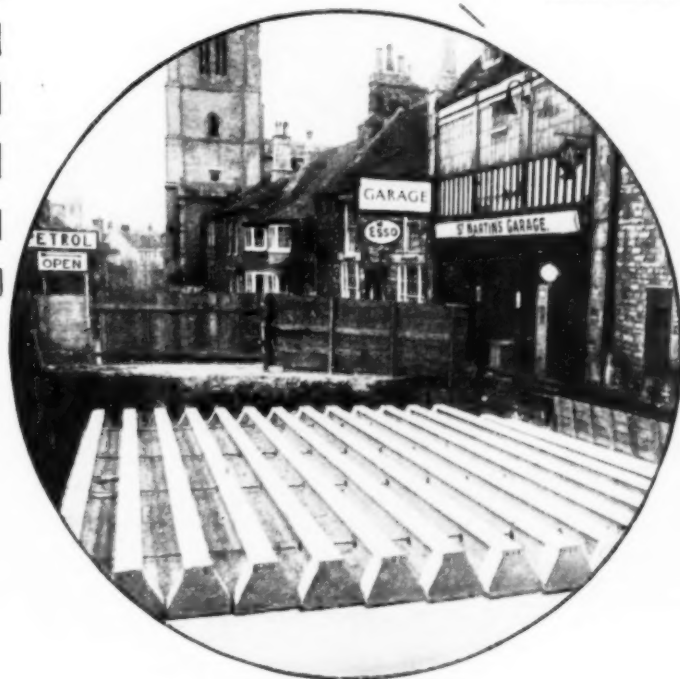
**RAIL BRIDGES**

**ROOF**

**AND**

**FLOOR**

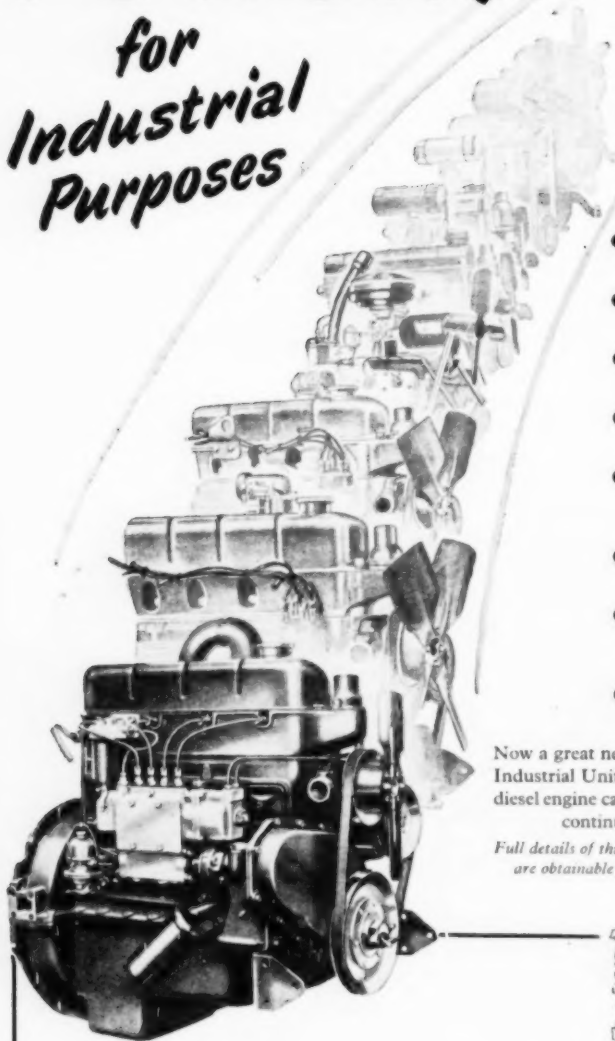
**BEAMS**



**ANGLIAN BUILDING PRODUCTS LTD · LENWADE 15 · NORWICH · Tel. : Gt. Witchingham 91**

# POWER!

for  
Industrial  
Purposes



## ENGINE 12 HOURLY RATINGS

- 933 cc. PETROL (4 cyl.)  
8 B.H.P. @ 1500 R.P.M.  
13.75 B.H.P. @ 2500 R.P.M.
- 1172 cc. PETROL (4 cyl.)  
11.5 B.H.P. @ 1500 R.P.M.  
19 B.H.P. @ 2500 R.P.M.
- 1508 cc. PETROL (4 cyl.)  
17 B.H.P. @ 1500 R.P.M.  
28 B.H.P. @ 2500 R.P.M.
- 2262 cc. PETROL (6 cyl.)  
24 B.H.P. @ 1500 R.P.M.  
40 B.H.P. @ 2500 R.P.M.
- 3621.5 cc. PETROL  
(V-8 cyl.)  
34 B.H.P. @ 1500 R.P.M.  
56 B.H.P. @ 2500 R.P.M.
- 3260 cc. PETROL (4 cyl.)  
22 B.H.P. @ 1000 R.P.M.  
35.5 B.H.P. @ 1600 R.P.M.
- 3610 cc. VAPORISING OIL  
(4 cyl.)  
22 B.H.P. @ 1000 R.P.M.  
34.5 B.H.P. @ 1600 R.P.M.
- 3610 cc. DIESEL (4 cyl.)  
22 B.H.P. @ 1000 R.P.M.  
36 B.H.P. @ 1600 R.P.M.

Now a great new star joins the range of Ford Industrial Units — an entirely new 4-cylinder diesel engine capable of maintaining 34 B.H.P. continuously at 1500 R.P.M.

Full details of this and all other engines in the range are obtainable from our Industrial Units Dept.

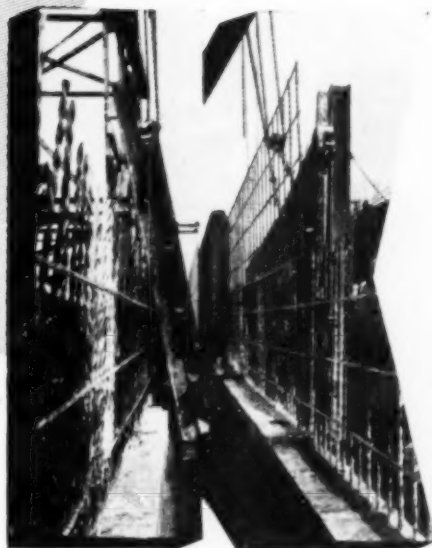


BY APPOINTMENT MOTOR  
VEHICLE MANUFACTURERS TO  
THE LATE KING GEORGE VI

FORD MOTOR COMPANY LIMITED • DAGENHAM • ESSEX



## REINFORCED CONCRETE CONSTRUCTION



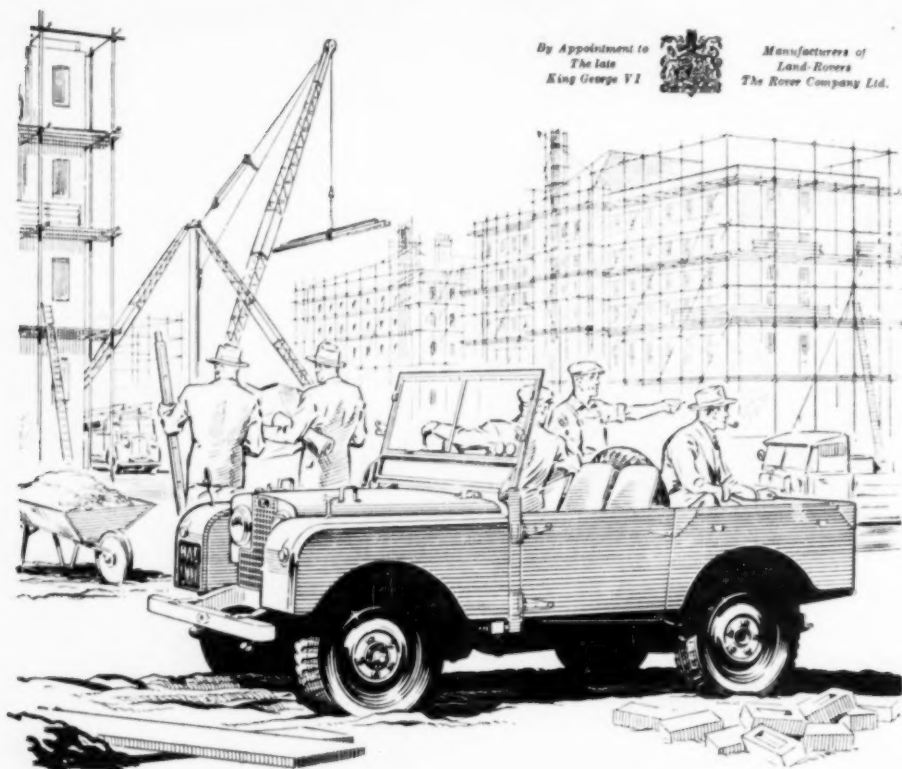
HEAVY REINFORCED  
CONCRETE RETAINING WALL IN  
COURSE OF CONSTRUCTION



**UNITED KINGDOM CONSTRUCTION  
& ENGINEERING COMPANY LTD..**

CIVIL ENGINEERING CONTRACTORS  
HAMMOND ROAD, KIRKBY INDUSTRIAL ESTATE, LIVERPOOL  
TELEPHONE, SIMONSWOOD, 2401 (3 LINES)





By Appointment to  
The late  
King George VI



Manufacturers of  
Land-Rovers  
The Rover Company Ltd.

## **The 4-wheel drive all-purpose vehicle**

Wherever buildings are going up you need something besides the heavy vehicles, the tractors, the bulldozers—you need the sturdy, speedy, versatile Land-Rover. It's a handy vehicle for the odd jobs, for liaison between site and office; and besides that, its power take-off (providing either belt or shaft drive) makes it a mobile power unit which takes rough ground in its stride and brings power to where it's wanted—right on the spot.

# **LAND- ROVER**

**Britain's most versatile vehicle**

**MADE BY THE ROVER COMPANY LIMITED, SOLIHULL, BIRMINGHAM**

CVS-44

# FRAMEWELD

Trade Mark

Patent No. 589066

IT STANDS ALONE

*Prefabricated  
Welded Reinforcement  
saves  
TIME  
MONEY  
LABOUR*

DESIGN · FABRICATION · ERECTION

## **T.C. JONES**

& CO. LTD

**Reinforcement Specialists**

*1903-1953 Fifty Years of Service to Industry*

WOOD LANE, LONDON, W.12. Tel: Shepherds Bush 2020

BUTE STREET, CARDIFF.

Tel: Cardiff 28786

TREORCHY, GLAMORGAN.

Tel: Pentre 2381

THE  
**600**  
GROUP  
OF COMPANIES

# GUNITE AND CEMENTATION



Systematic repairs to structures  
based on systematic diagnosis of  
defects.

## WHITLEY MORAN & CO. LTD.

*Specialists in the Repair of Engineering Structures*

**GUNITE**

5 OLD HALL STREET, LIVERPOOL.

Telephone: Central 7975



## THE "JOHN BULL" CONCRETE BREAKER

NEW "B.A.L." TYPE.

**INCREASED :—**

PENETRATION, RELIABILITY, LIFE.

**REDUCED :—**

VIBRATION, NOISE AND WEAR.

THESE ARE THE SALIENT FEATURES  
OF THE NEW CONCRETE BREAKER

★ ★ ★

## REAVELL & CO., LTD.

RANELAGH WORKS, IPSWICH.

TELEGRAMS: "REAVELL, IPSWICH."

TELEPHONE: 2124

# CONCRETE PILING LTD

CIVIL ENGINEERING CONTRACTORS



Lee Conservancy Catchment Board Act, 1938. Flood Relief Scheme Contract No. 2.

The illustrations show views of the Leyton Marsh Culvert with Lee-McCall System of Post Tensioned Beams in Place.

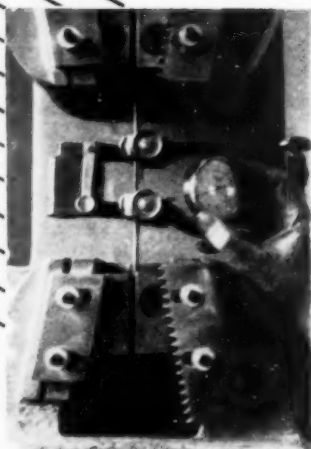
Engineer to the Board: Marshall Nixon, Esq., B.Sc., A.M.I.C.E., A.M.I.Mech.E.



10, WESTMINSTER PALACE GARDENS, ARTILLERY ROW, LONDON, S.W.1. - ABBEY 1626  
LADAS DRIVE, BELFAST - BELFAST 58100 - WORKS, RIVER RD. BARKING - RIPPLEWAY 2624

# Tensile TOUGHNESS

Extensometer used in conjunction with 10-ton Tensile Testing Machine at Quality Control Laboratory, Doncaster, when testing high tensile steel wire for prestressed concrete.



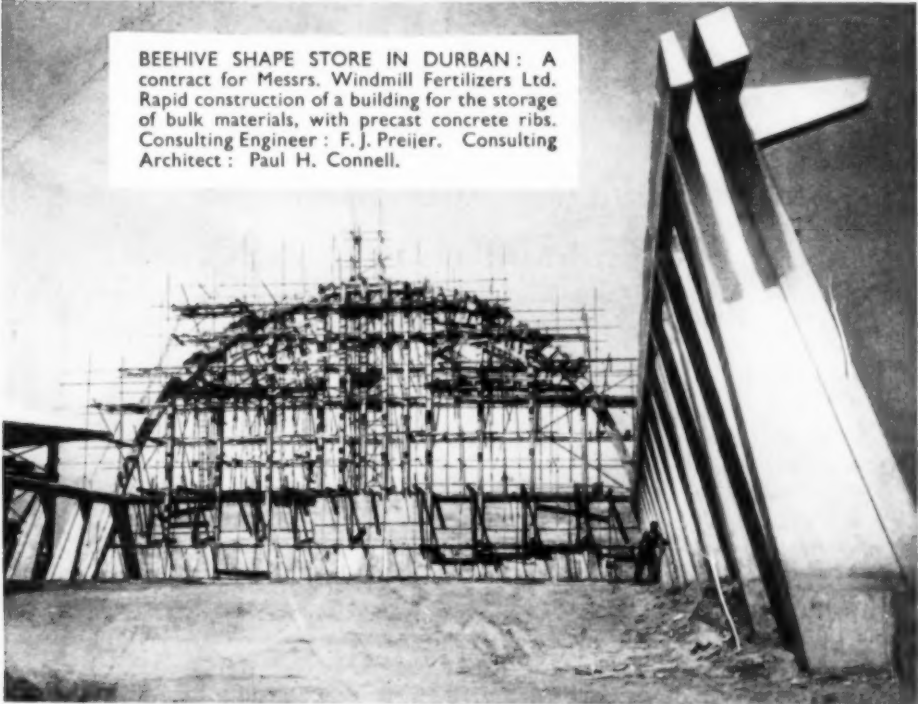
## PRESTRESSED CONCRETE WIRE

Tests carried out in the Quality Control Laboratory check each stage of manufacture and ensure the quality of the high tensile steel wire produced specially for the prestressed concrete industry by British Ropes Limited.

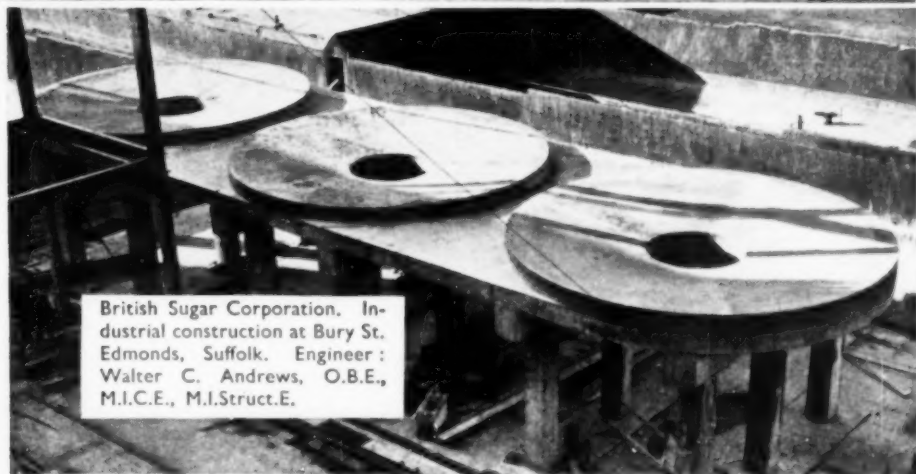
*Laboratory tested*  
.. at every stage

**BRITISH ROPES LTD** *for all kinds of*  
**WIRE**  
AND BRIGHT BARS

HEAD WIRE SALES OFFICE : DONCASTER.  
AREA OFFICES :  
BIRMINGHAM, CARDIFF, GATESHEAD,  
LIVERPOOL, LONDON, RUTHERGLEN.



BEEHIVE SHAPE STORE IN DURBAN: A contract for Messrs. Windmill Fertilizers Ltd. Rapid construction of a building for the storage of bulk materials, with precast concrete ribs. Consulting Engineer: F. J. Preijer. Consulting Architect: Paul H. Connell.



British Sugar Corporation. Industrial construction at Bury St. Edmonds, Suffolk. Engineer: Walter C. Andrews, O.B.E., M.I.C.E., M.I.Struct.E.

## RUSH & TOMPKINS LTD.

BUILDING AND CIVIL ENGINEERING CONTRACTORS

SIDCUP • LONDON • BIRMINGHAM • DURBAN • COLOMBO

# ★ CHASTON

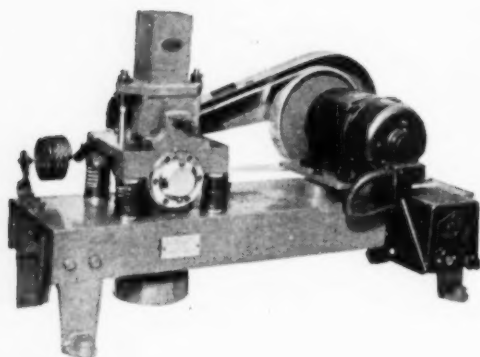
**SPECIALIST CONTRACTORS  
FOR REINFORCED CONCRETE  
AND PRECAST PRODUCTS**

WE INVITE YOUR  
ENQUIRIES FOR CON-  
CRETE WORK OF ALL  
KINDS, IN STANDARD  
OR SPECIAL DESIGNS

## PRESTRESSED STRUCTURAL UNITS

DAVID CHASTON LTD., ESSEX ROAD, HODDESDON, HERTS.  
Telephone: Hoddesdon 2264 (3 lines).

## "CAPCO" H. F. VIBRATOR



for compacting mortar cubes  
for Compression Test B.S.  
12/1947, B.S. 915/1947,  
B.S. 146/1947, B.S. 1370/  
1947. New type automa-  
tic control—optional. The  
vibrator illustrated in the  
B.S. was built in our works.

The "CAPCO" range of con-  
crete testing apparatus also  
includes Cube Moulds; Slump  
Cones; Tensile, Vicat, and Cylin-  
drical Moulds; Tile Abrasion  
Machines; Compacting Factor  
Apparatus.

Full details on request.

### CAPCO (SALES), LTD.

BEACONSFIELD ROAD, LONDON, N.W.10.

Telephone: WILLESDEN 0067-8. Cables: CAPLINKO, LONDON

(Sole Agents for all  
"Capco" Products)





Expanded Metal Reinforcement was used for the 330 ft. span double hangar at the Marseilles-Marignane Airport, France. Ordinary round steel rods were originally specified but Expanded Metal was adopted finally for the following reasons: (1) Superior Bond . . . slipping impossible.

(2) Protection of Steel better assured because sheets could be placed more exactly at centre of concrete without risk of displacement during concreting. (3) Better distribution of steel for equal weight per sq. yard. (4) Simplification of the reinforcement.

*Designed and built by Des Entreprises Boussiron.*

*Photo: Ray-Delvert.*

# Expanded Metal

THE EXPANDED METAL COMPANY LTD., Burwood House, Caxton Street, London, S.W.1 ABBey 3933  
Stranton Works, West Hartlepool Hartlepool 2194

ALSO AT: ABERDEEN, BELFAST, BIRMINGHAM, CAMBRIDGE,  
CARDIFF, EXETER, GLASGOW, LEEDS, MANCHESTER



## EXPAMET' PRODUCTS

Expamet Expanded  
Steel and Aluminium  
Flattened Expamet  
BB Lathing  
Exmet • Ribmet  
Super-Ribmet  
XPM Welded Fabric



## 1000 ft. of Prestressed Concrete Culvert



Engineer to the Lee Conservancy Catchment Board: M. Nixon, M.B.E., B.Sc., A.M.Inst.C.E.  
Prestressed concrete beams made by Shockcrete Products Ltd. for the main contractors, Concrete Piling Ltd.

As part of the flood relief scheme of the Lee Conservancy Catchment Board in the valley of the River Lee, a new channel is being constructed, of which about one half is to be a culvert decked by Lee-McCall prestressed concrete beams. There are 512 beams, each having an overall length of 57 ft., giving a clear span between the walls of the culvert of 53 ft. 5 in. The beams are of I-section, 30 in. deep by 24 in. wide, each containing three 'MACALLOY' bars of  $1\frac{1}{8}$  in. dia. After the beams have been placed in position, they are prestressed transversely in bays 20 beams wide, by ten  $\frac{7}{8}$  in. dia. 'MACALLOY' bars.

Particulars are given in Bulletin No. 2 which is available on request.

### PRESTRESSED CONCRETE



**McCALLS MACALLOY LTD.**

**• • • TEMPLEBOROUGH SHEFFIELD**

# Foundations in Foul Ground

Owing to its chemical composition, concrete made with **CIMENT FONDU** is resistant to the disintegrating influences met with in foul ground



## SULPHATES

It is entirely immune from attack by magnesium sulphate or sulphate of lime, whether in the form of gas lime, gypsum or anhydrite.



## SOFT, ACIDIC OR PEATY WATERS

Very pure waters or waters containing aggressive carbon-dioxide do not affect Ciment Fondu concrete.



## MADE-UP GROUND

Ciment Fondu concrete offers maximum resistance to a wide variety of waste chemicals.

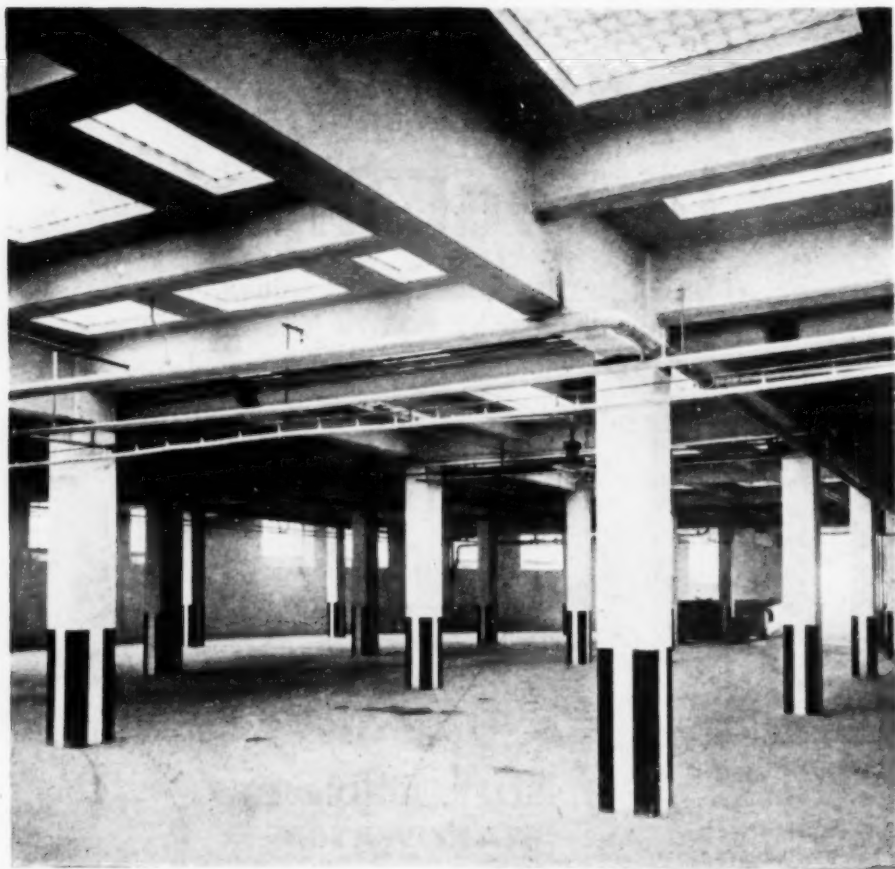
**Concrete Rock-Hard within one day**



LAFARGE ALUMINOUS CEMENT CO., LTD., 73 BROOK ST., LONDON, W.1

Tel.: MAYfair 8546

98 Y-1081A



## HAYWARDS "CRETE-O-LUX" LIGHTS

of reinforced concrete construction, are purpose-made and precast (unless otherwise required) for maximum efficiency and dependability. These Lights meet every need of present-day practice, being specially designed for Pavements, Roadways, Floors, Stall-boards, Roofs, Domes, Canopies, Lanterns, Windows, etc. Their use ensures good appearance and the best possible transmission of light. *Technical details, with estimates if desired, on request.*

# HAYWARDS LTD

UNION STREET, LONDON, S.E.1

TELEPHONE : WATERLOO 6035 (PVTE. BRCH. EXCHANGE)

---

---

---

# MONK

OF

**WARRINGTON & LONDON**

*are organised and equipped  
to carry out*

**REINFORCED CONCRETE  
CIVIL ENGINEERING  
& BUILDING CONSTRUCTION**

*This organisation has been  
responsible for the construction of many  
major projects at Home and Overseas*

**A. MONK & COMPANY LIMITED**

*Head Office :  
Padgate, Warrington  
Tel : Warrington 2381*

*London Office :  
75, Victoria Street, S.W.1  
Tel : Abbey 2651*



## ***that arresting* WHITENESS**

How dramatically the whiteness of the barque's sails — against the deep background of sky and sea — arrests the eye!

So the architect, by using Snowcrete, can emphasise a particular feature; can cause a whole building to dominate its darker neighbours. Snowcrete is also used for producing renderings, facings, terrazzo and cast stone of great durability.

# SNOWCRETE

## WHITE PORTLAND CEMENT

*Full particulars from:*

**THE CEMENT MARKETING COMPANY LIMITED**

PORTLAND HOUSE, TOTHILL STREET, LONDON, SW1.

G. & T. EARLE LIMITED, WILMINGTON, HULL

THE SOUTH WALES PORTLAND CEMENT & LIME COMPANY LIMITED, PENARTH, GLAM.



**BRITISH CEMENT IS THE CHEAPEST IN THE WORLD**



*You need VIBRATING EQUIPMENT?  
then get the best*

choose

**ALLAM**

**PETROL & ELECTRIC  
VIBRATING  
TAMPERS  
SALE OR HIRE**

Details of these, all types of internal and external vibrators, and contractors' plant sent on request.

**E. P. ALLAM & CO. LTD.**

**LONDON:** 45 Great Peter Street, S.W.1. • **Telephone:** Abbey 6353 (5 lines)  
**SCOTLAND:** 39 Cavendish St., Glasgow, C.5. **Tel:** South 0186. **Works:** Southend-on-Sea. **Tel:** Eastwood 55243

**STENT**

PRECAST CONCRETE

*Piles*

**PRESTRESSED PILES**

**STENT PRESTRESSED PILES** have satisfactorily withstood practical tests and have the advantages of smaller scantlings, greater length and easier handling. Illustration shows a 12" x 12" x 55 long pile on a site where several hundreds were used most successfully.

**STANDARD REINFORCED PILES**

**STENT R.I. PILES** maintain their long proven popularity. They are Reliable, Economic and Readily Available. In shorter lengths, they will probably remain unchallenged even by the **STENT PRESTRESSED PILE**. Stock sizes: 12" x 12" in lengths 15 ft.-40 ft. 14" x 14" in lengths 15 ft.-55 ft.

**STENT** PRECAST  
CONCRETE  
LIMITED

1 Victoria Street, London, S.W.1. Phone: Abbey 2573 & 2416  
Works: Dagenham Dock, Essex. Phone: Rainham (Essex) 780

*Specify  
**STENT**  
For the  
RIGHT Pile*





A symbol of quality materials, experienced workmanship, expert supervision, and excellent service.

## for all forms of **PRECAST CONCRETE**

We specialise in the production of Precast Concrete structural members to standard or special designs, also products for the Electrical Industry, Sports Ground Contractors, and Fencing Contractors, and shall be pleased to submit quotations for your requirements.

## **H.B. CONCRETE CO. LTD.**

Head Office and Works : VICARAGE ROAD, EGHAM, SURREY. Telephone : Egham 3092.



**DELIVERED DIRECT TO ANY  
CONTRACT BY MOTOR LORRY.**

**Quotations on Application.**

Telephone : Paddington 2024 (3 lines).

## WASHED **BALLAST, SAND, SHINGLE & Crushed Aggregate for Reinforced Concrete.**

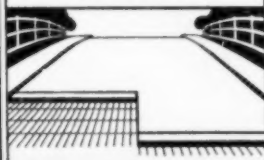
**WILLIAM BOYER & SONS, LTD.**

*Sand and Ballast Specialists,*

**IRONGATE WHARF,  
PADDINGTON BASIN, W.**

**MEMBERS OF B.S. & A.T.A.**

**BRC  
FABRIC**

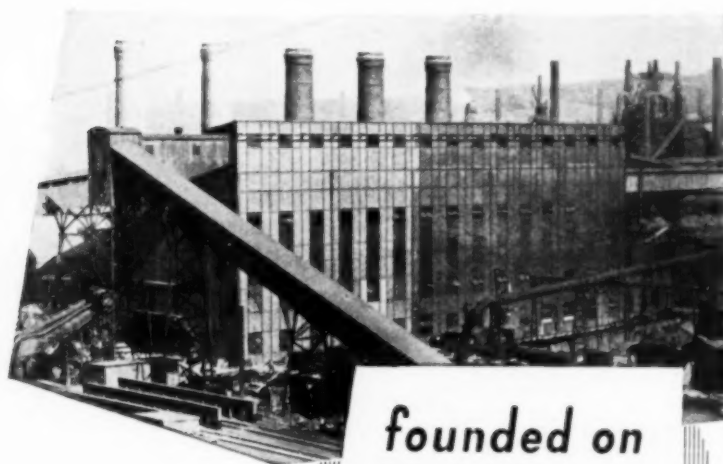


**FOR ROAD  
REINFORCEMENT**

## "CONCRETE SERIES" **BOOKS ON CONCRETE**

These well-known books deal with practically every aspect of the design and construction of reinforced concrete and precast concrete, the manufacture and chemistry of cement, and kindred subjects. For a complete catalogue giving prices in sterling and dollars, send a postcard to :

**CONCRETE PUBLICATIONS, Ltd.**  
14 Dartmouth St., London, S.W.1  
England



*founded on*  
**FRANKIPILES**

**Boiler House Extension,  
Cleveland Works.**

*Photograph by courtesy of:*

Messrs. Dorman Long & Co. Ltd.

## **FRANKIPILE**

(THE FRANKI COMPRESSED PILE CO. LTD.)

**39 Victoria Street,  
London, S.W.1**

Telephone: ABBey 6006-9

'Grams: Frankipile Sowest London

And in

AUSTRALASIA

BRITISH WEST INDIES AND SOUTH AFRICA

---



*Candy Filter House for South-West Suburban Water Company.  
Mr. H. Austin Palmer, Engineer.*

THE BEST WAY to illustrate CONCRETE  
is by HALF-TONE BLOCKS  
OF THE HIGHEST QUALITY

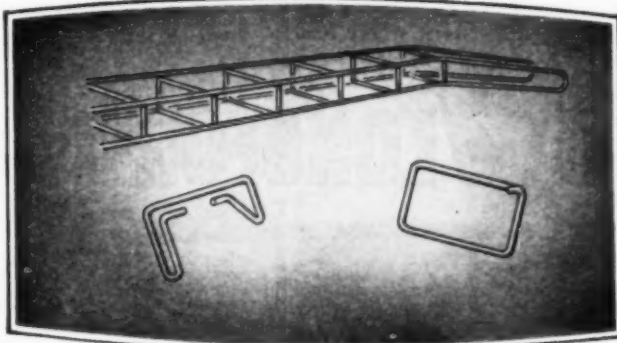
*Complete Service of*  
ENGRAVING, TYPESETTING,  
PHOTOGRAPHY,  
ELECTROTYPING and STEREO-  
TYPING and ARTISTS' WORK

THE STRAND ENGRAVING COMPANY LIMITED  
8 & 9 ESSEX STREET, STRAND, W.C.2

Telephone: Temple Bar 6311.

Engravers to "Concrete."

# CONCRETE REINFORCEMENT



We carry large stocks of M.S. and High Tensile Steel, which can be supplied cut to lengths, hooked and bent in accordance with schedules, or in random stock lengths, from our Stock-holding Department.

We specialise in Large projects, for which our Designers are always at your service.

FOR ALL CONSTRUCTION PURPOSES

**SOMMERFELDS LTD.**

WELLINGTON • SHROPSHIRE • Tel.: Well. 1000

LONDON OFFICE: 167 VICTORIA ST. • TELEPHONE: VICTORIA 1000



*Specialists in the Repair and Reconditioning of  
Defective Reinforced Concrete Structures, etc.*

THE

**GUNITE**  
CONSTRUCTION CO. LTD

WESTERN HOUSE, HITCHIN, HERTS.

QUICKEST & MOST ECONOMICAL FOR  
**shuttering long, straight runs of Concrete Walls**

of any height and thickness, vertical or battered faces

# ACROW LONGFORMS

(Patent)

## HERE ARE 5 REASONS WHY:—

### SPEED

Main Longform Unit is 10 ft x 1 ft, giving a larger shuttering surface per unit than is obtainable by other methods.

### SPEED

All Longform Units are self-aligned by Registering-Lugs in bottom flanges. Additional waling is therefore unnecessary.

### CONCRETE-PLACING ACCESS

The great longitudinal rigidity of LONGFORMS enables Standards to be spaced at 5 ft. centres, thus allowing ample space for pouring concrete.

### SPEED—and SAVING of LABOUR

The whole assembly shown here can be struck and lifted integrally to the third lift by crane.

### ECONOMY

Out of a total available working height of 4 ft 0 in., only 6 in. are taken up by lapping on previous pour.

### Other uses for LONGFORMS

Because they require no bracing or raking supports, Longforms can also be used for walls which need shuttering on one side only. Because of their comparatively great length and narrow width they are ideally suited for shuttering to curved or barrel-vault roofs.

FOR  
 SALE  
 OR HIRE

### STANDARDS ARE AVAILABLE IN TWO SIZES

No. 1 (for 4 ft. lifts) 6 ft. high

No. 2 (for 6 ft. lifts) 8 ft. high

All Enquiries to: **ACROW (ENGINEERS) LTD.**

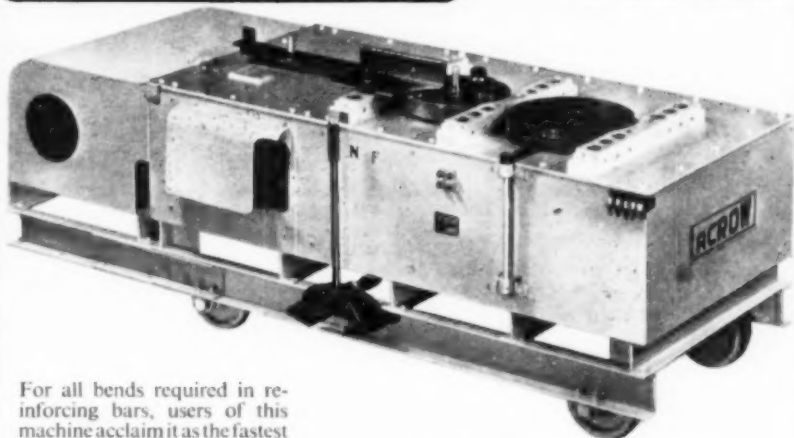
(for addresses see facing page)

# ACROW

## Power BAR BENDING MACHINE

*fastest:  
most accurate:  
minimum of handling:  
automatic repetition:  
bends up to 2" diam.*

FOR SALE OR HIRE



For all bends required in reinforcing bars, users of this machine acclaim it as the fastest and most reliable. Robustly designed to withstand continuous heavy duty, it bends single bars up to 2 in. diameter or a group of bars of a combined cross-sectional area of up to 3 sq. in.

The machine is available with electric motor, petrol engine or diesel engine, as required.

For full details and price, write to :

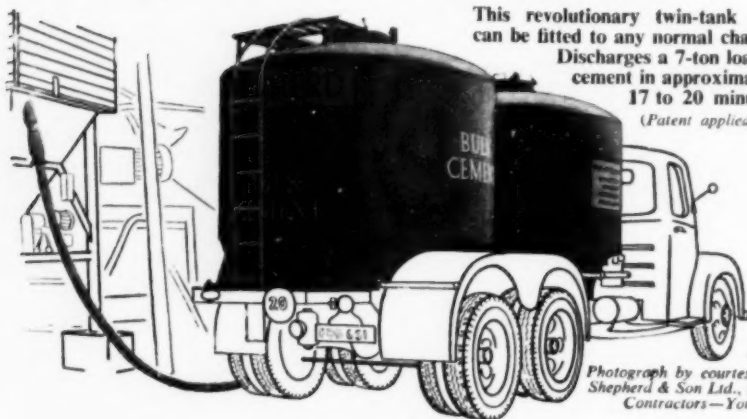
### ACROW (ENGINEERS) LTD.

South Wharf, Paddington, London, W.2	Ambassador 3456
22-24, City Road, Bristol, 2	Bristol 24595
130, Coventry Drive, Glasgow, E.1	Bridgeton 1041
Lupton Street, Hunslet, Leeds, 10.	Leeds 76514
West Stanley Street, Manchester, 5	Trafford Pk. 2965
Carl Street, Walsall, Staffs.	Walsall 6296
78, Duncrue Street, Belfast	Belfast 45211

# The LATEST DEVELOPMENT in

## TRANSPORTING and UNLOADING

# BULK CEMENT



This revolutionary twin-tank unit can be fitted to any normal chassis.

Discharges a 7-ton load of cement in approximately 17 to 20 minutes.

(Patent applied for)

Photograph by courtesy of F. Shepherd & Son Ltd., Building Contractors—York.



Designed and built by engineers who have had many years experience of bulk transport problems, this twin-hopper cement carrier provides the complete answer to the public works contractors' cement supply problems. There are no questions of bags, manhandling or wastage with this equipment—cement is loaded at works in bulk and discharged when and where needed speedily and economically. The twin unit illustrated carries 7 tons of cement which can be unloaded on site in 17 to 20 minutes—and this to a height of 45 ft. above ground if necessary. The hopper units with ancillary equipment can be fitted singly or in multiples to suitable types of vehicle or trailer. In short, bulk cement transport is here—for every class of user.

Full specifications gladly supplied on request.

*Sole Distributors:*

**THOS. W. WARD LTD**  
**Albion Works, Sheffield**

London; Manchester; Glasgow; Briton Ferry; Birmingham; Middlesbrough.

Manufactured by Yorkshire Engineering and Welding Co., Ltd. Bradford  
LC/2B



# CONCRETE AND CONSTRUCTIONAL ENGINEERING

INCLUDING PRESTRESSED CONCRETE

Volume XLVIII, No. 5.

LONDON, MAY, 1953.

## EDITORIAL NOTES

### Building Research.

At a conference on research held by the National Federation of Building Trades Employers recently, the secretary of the Department of Scientific and Industrial Research said he did not believe that the wider and speedier application of science in the building industry could be brought about by an extension or intensification of effort on the present lines. He also expressed the views that the industry generally did not take sufficient interest in science and research, and that "builders would be far readier to listen to those within their own trade than to outsiders like scientists". The Federation was urged to set up its own research groups for the purpose of sponsoring and organising investigations, for receiving "information in bulk" from scientists, and for providing "wider and more systematic channels" of co-operation with the research worker.

It would be hardly surprising if builders were sceptical of the value to them of official research, for in concrete and reinforced concrete at any rate it is difficult to name any recent improvement in materials, processes, or machinery used in the industry which has originated from a British scientist, a British official research laboratory, or indeed anywhere in Britain. It is lamentable that so many of the developments in concrete and reinforced concrete have come from abroad. The fact that reinforced concrete was invented in France is not a good reason why none of the developments during the past hundred years originated in this country, particularly during the past thirty years when such large sums have been spent here on research. During this period of intensified research the British contribution to the development of concrete and reinforced concrete has been negligible.

For example, among the newer lightweight aggregates, foamed slag was used first in Austria and Germany, and expanded slate and vermiculite in the United States. Aerated and "gas" concretes were mainly introduced into this country when German patents and processes were revealed after the war. Air-entraining admixtures and "vacuum" concrete were developed in America many years ago, and were only recently available here. "No-fines" concrete was used in Holland forty or more years ago. Sawdust-concrete and wood-wool-cement slabs were first used in Central Europe. Types of rapid-hardening or high-early-strength cements appear to have been made on the Continent early in the century, and in this country nearly twenty years later. High-alumina and expansive cements were French discoveries, and blastfurnace cements were first made in Germany. Among the newer types of reinforcement, twin-twisted high-tensile

bars were first used in Germany and indented bars in France, Germany, and the United States.

In the making of concrete and building in concrete we have also largely depended on ideas and improvements from abroad. Weigh-batching mixing plant came from America, as also did chuting towers and the first systems of steel shuttering. Electric vibrating machines of the shutter and immersion types originated on the Continent. Tower cranes are imported from France. The concrete pump and pipeline are of Continental origin. Modern earth-moving equipment was introduced from the United States for the construction of runways during the war. The machine which spreads, tamps, and finishes concrete for roads was produced in Germany in the 1930's. The delivery of loose cement in special vehicles originated on the Continent, and the cement-pump in the U.S.A. The use of paper valve-bags instead of jute sacks for cement was an American idea. Central concrete-mixing plants and vehicles for mixing concrete in transit were common in the United States and elsewhere before they were introduced here. Soil-cement roads were first built in the United States and elsewhere. The chemical consolidation of soil is a Continental invention. The centrifugal process of making concrete pipes and poles came from the Continent and Australia, and continuous roofing-tile machines and many other machines for making concrete products from the Continent.

Although work done in this country on the creep of concrete is of value in the design of prestressed concrete, the major practical applications of prestressed concrete were due entirely to Continental engineers; it must, however, be mentioned as a notable exception that the latest development in the manufacture and use of post-tensioned high-tensile bars is the invention of British engineers. The "shell" roof originated in Germany. In Great Britain the possibilities of facilitating construction by precasting structural members are now realised, but progress has been slow since, in the 1920's, thirty two-story houses were built at Cambridge by a Continental "tilt-up" method in which complete walls were cast on the ground and hoisted into position by a crane. Some of the precast beams made in Great Britain are based on Continental or American designs. It is a revealing experience to see in foreign publications illustrations of the remarkable sizes and shapes of precast members used abroad, particularly in Italy, Czechoslovakia, and Central and South America.

It is depressing to find that a nation that at one time claimed to lead the world in inventiveness has contributed so little to progress in concrete and reinforced concrete, and it would not be surprising if the industry looked upon scientists as "outsiders", for it is hardly to be expected that inventions and ideas such as those mentioned would come from scientists working in a laboratory. It has often been said that the building industry is backward in adopting new ideas, but we have yet to meet an engineer or builder who would not do so when it was proved to his satisfaction that a new material or process or machine would be advantageous to him. But such ideas mostly come from manufacturers and builders actively employed in their trades, and not from official laboratories whose work might be better confined to "fundamental" research of the kind now being carried out by the Department of Scientific and Industrial Research on the constitution of Portland cement, and on such matters as the fire-resistance and durability of materials and the testing of full-size structures.

# Prestressed Precast Concrete Footbridges.

By N. A. DEWS.

In this journal for August, 1952, the writer gave a design for a footbridge consisting of prestressed precast concrete units for use on remote sites. If, however, the site is within a reasonable distance from a hard road the alternative design shown in *Fig. 1* can be quickly erected and is low in first cost and maintenance cost. The bridge comprises two precast prestressed beams connected by small in-situ diaphragms which also serve as supports for the precast prestressed deck.

If many bridges are to be provided by one authority, there will almost certainly be several that can be grouped into spans of standard length, so that adherence to the minimum span would be unnecessary. The beams would be factory-made with bonded wires, and designed so that no special precautions in handling or transporting are necessary.

The method of determining the prestressing force is similar to the method suggested in the previous article but with a slight modification of the stresses in the top face. During transport or while being placed in position the beam may possibly be slung from points other than the ends, or it may be rolled into position; the most severe case will be when it is supported at the centre, thereby producing a reversal of the usual stresses due to bending. If tensile stresses are not permitted, and this is advisable for these small beams, precompression must be provided in the top face equal to or greater than the tensile stress  $c_t''$  due to bending; the eccentricity of the stressing force must then be within the core of the beam, that is less than  $\frac{r^2}{y_t}$ . For this condition of reversed bending moment the beam could be handled either before or after all the losses of prestress have occurred, and the lower limit is

$$\frac{nP}{A} \left( 1 - \frac{ey_t}{r^2} \right) - c_t'' = 0 \quad (1a)$$

For the upper limit at the top face, that is with the beam in position and all the loads acting, the permissible compressive stress  $c_a$  must not be exceeded; this condition can occur before losses of prestress have taken place, and the limit is

$$\frac{P}{A} \left( 1 - \frac{ey_t}{r^2} \right) + c_t + c_t' = c_a \quad (2a)$$

The two limits for the bottom face are as given in the previous article. The ordinates for  $1000 \cdot A \div P$  where  $e = 0$  are (1a),  $\frac{1000n}{c_t''}$ ; (2a),  $\frac{1000}{c_a - c_t - c_t'}$ ; (3),  $\frac{1000}{c_a + c_b}$ ; and (4),  $\frac{1000n}{c_b + c_b'}$ .

With  $e = \frac{r^2}{y_t}$  in cases 1a and 2a and  $e = -\frac{r^2}{y_b}$  in cases 3 and 4 as before, a diagram similar to *Fig. 2* results, giving a kern in which are acceptable values for  $P$  and  $e$  for the required conditions.

The properties of the section in *Fig. 1* are as follows (in inch units):  $A = 68$ ,

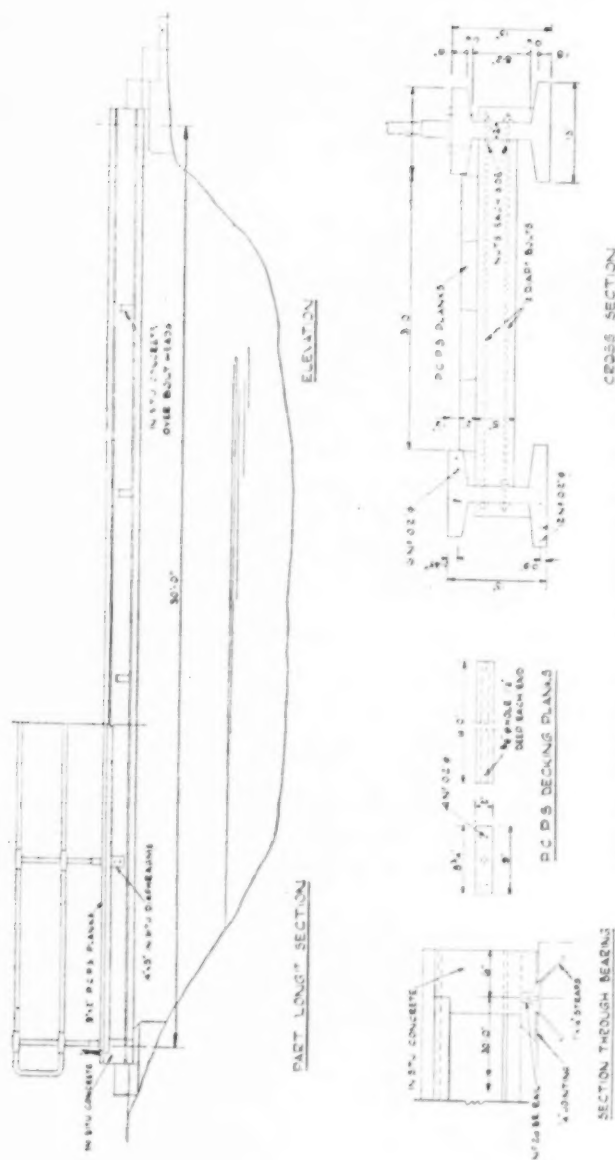


Fig. 1.—Design for a Prestressed Concrete Footbridge.

$y_t = 6.85$ ,  $y_b = 6.15$ ,  $I = 1620$ ,  $r^2 = 23.82$ ,  $\frac{r^2}{y_t} = 3.48$ ,  $\frac{r^2}{y_b} = 3.87$ ; weight per foot = 72 lb.

When the beam 31 ft. long is slung or supported at the centre:  
 $M = \frac{1}{2} 15.5^2 \times 72 \times 12 = 103,790$  in.-lb.;  $c_t'' = \frac{103,790 \times 6.85}{1620} = 439$  lb. per square inch (tension).

With the beam in position:  $M = \frac{1}{8} 72 \times 30^2 \times 12 = 97,200$  in.-lb.

$$c_t = \frac{97,200 \times 6.85}{1620} = 411 \text{ lb. per square inch (compression).}$$

$c_b = \frac{97,200 \times 6.15}{1620} = 369$  lb. per square inch (tension). The loads added after the beam is placed are (in lb. per foot): Handrail 8, diaphragms 4, deck 38; total 50. The live load at 80 lb. per square foot is 120, and the bending moment due to these added loads is  $\frac{1}{8} 170 \times 30^2 \times 12 = 229,500$  in.-lb.  $c_t' = 970$  lb. per square inch (compression) and  $c_b' = 870$  lb. per square inch (tension).

The ordinates for  $e = 0$  in Fig. 2 are:

$$(1a), \frac{850}{439} = 1.94; (2a), \frac{1000}{2000 - 411 - 971} = 1.62;$$

(3),  $\frac{1000}{2000 + 369} = 0.422$ ; and (4),  $\frac{850}{369 + 870} = 0.685$ . It is seen that  $e$  is between 1.4 and 2.3 with  $1000.A \div P$  between 1.02 and 0.65; with  $A = 68$ ,

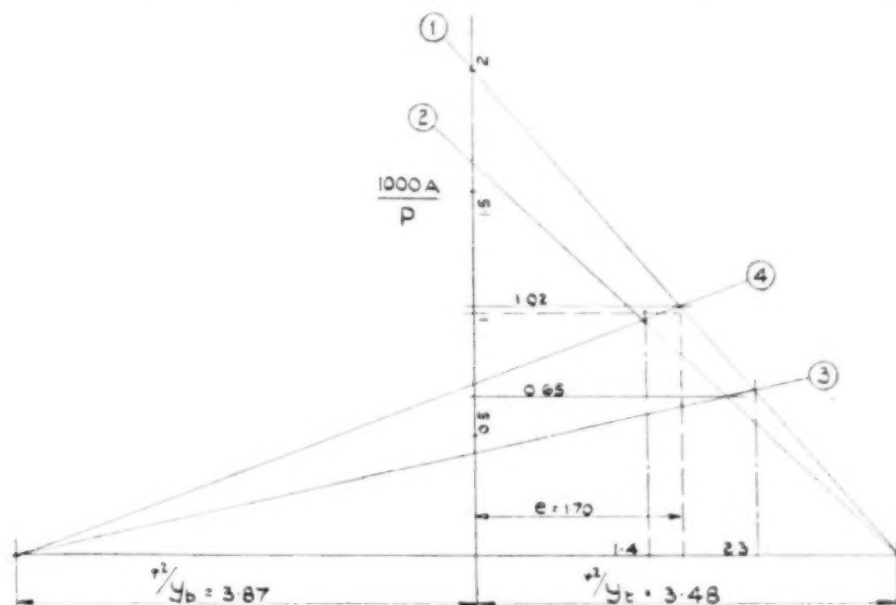


Fig. 2.

$P$  is 66,700 to 104,600 lb. Using 18 wires of 0.2-in. diameter stressed to 120,000 lb. per square inch a force of 67,900 lb. is provided; with this force  $1000A \div P$  is nearly 1, indicating an eccentricity of 1.7 in. (it should be noted that extreme accuracy is not necessary in these diagrams as the final stresses for the values chosen for  $P$  and  $e$  are derived mathematically).

The stresses resulting from the force of 67,900 lb. are

$$p_t = \frac{67,900}{68} \left( 1 - \frac{1.7}{3.48} \right) = 509 \text{ lb. per square inch (compression).}$$

$$p_b = \frac{67,900}{68} \left( 1 + \frac{1.7}{3.87} \right) = 1438 \text{ lb. per square inch (compression).}$$

Allowing 15 per cent. loss of prestressing force for creep, shrinkage, etc., these stresses become in course of time 446 lb. and 1258 lb. per square inch respectively. The combined stresses are: Top face—(1a),  $446 - 439 = 7$  lb. per square inch. (2a),  $509 + 411 + 970 = 1890$  lb. per square inch. Bottom face—(3),  $1438 - 369 = 1069$  lb. per square inch; (4),  $1258 - 369 - 870 = 19$  lb. per square inch. These stresses are all compressive, and as they are less than the permitted value of 2000 lb. per square inch the conditions are satisfied. Twelve wires are placed 0.9 in. from the bottom face and the remaining six wires are placed a distance from the top equal to  $6.85 - \frac{12 \times 5.25 - 18 \times 1.7}{6} = 1.25$  in.

Considering the condition without live load, the moment due to the total dead load of  $72 + 50$  lb. per foot is 164,700 in.-lb., producing stresses of 696 lb. and 625 lb. per square inch, and the combined stresses are then: Top: Due to bending, 696; initial prestress, 509; total, 1205 lb. per square inch (compressive). Bottom: Due to bending, -625; reduced prestress, 1258; total, 633 lb. per square inch (compressive).

Should the beam be off-loaded upside down, the prestress would remain the same but the distances to the neutral axis would be reversed; in this case no tensile stresses would occur, nor would the compressive stress be exceeded if the beam were supported at the centre. If the beam, still upside down, were supported at the ends the stresses  $c_t$  and  $c_b$  would be reversed and the condition would then be: Upper face (bottom of beam)—Due to bending, 369; initial prestress, 1438; total, 1807 lb. per square inch. Lower face (top of beam)—Due to bending, -411; reduced prestress, 446; total, 35 lb. per square inch. Lines for this or other conditions can be added to the diagram in Fig. 2, but the limiting cases can generally be reduced to four.

The 2-in. thick deck planks weigh about 20 lb. per foot; allowing 60 lb. per foot for live load on the 9-in. width, the bending moment on the span of 6 ft. is 4320 in.-lb., resulting in stresses of  $\pm 720$  lb. per square inch. A uniform compression of 750 lb. per square inch is produced by four wires. These planks have a small hole in each end for dowelling them to one another, and the end planks are concreted in with the in-situ concrete.

## Extension of the Dorchester Hotel, London.

THE Dorchester Hotel in Park Lane, London, was built in 1930, and has recently been extended by the provision of further bedrooms on one of the wings facing Deanery Street. When the hotel was designed this portion comprised a garage in the basement and a ground-floor car park. No extensions were then contemplated above the level of the pave-

the end of the existing wing and is 40 ft. wide. The floors had to span this width without intermediate support. There were only two possible positions in the garage for the main columns where they would not obstruct the entrances to the banqueting rooms, and where there was sufficient space in the basement to enable the column-bases to spread the load on

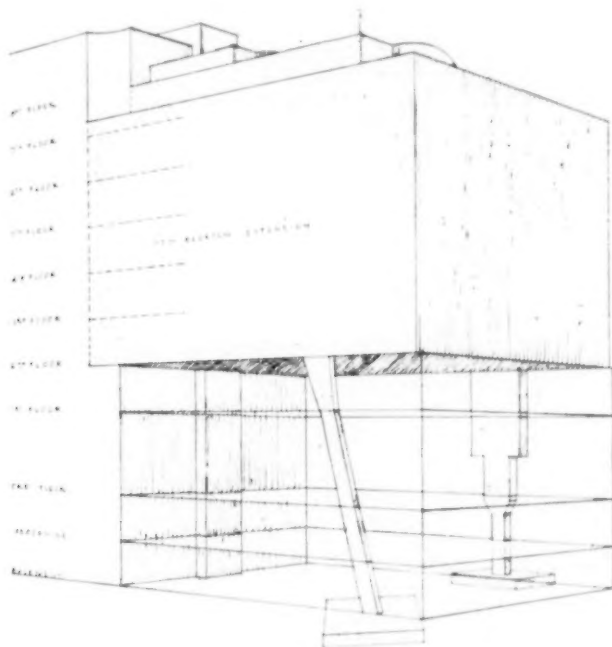


Fig. 1.—Diagrammatic Sketch showing the Method of Supporting the New Extension.

ment. In the year 1938, however, two banqueting rooms were built above ground-floor level and a third room constructed as a mezzanine in the garage. The present alteration required one of the wings to be extended outwards and built up to the full height of the hotel (about 90 ft. above the level of the pavement), and it was necessary to provide the supports for the additional six floors without preventing the use of the existing rooms below, or interfering with the use of the garage.

The extension is about 60 ft. long from

the ground at the stipulated safe pressure of 3 tons per square foot. Therefore the whole of the additional six floors are carried on two main columns at the eastern end with a support on the wall of the existing wing. Fig. 1 is a diagrammatic sketch by the architect of the new extension and its supports.

The construction of the lowest five new floors consists of cross beams 2 ft. deep spanning 40 ft., and connected by a solid reinforced concrete slab 4 in. thick. The ends of the cross-beams are carried on the side walls of the extension. These walls



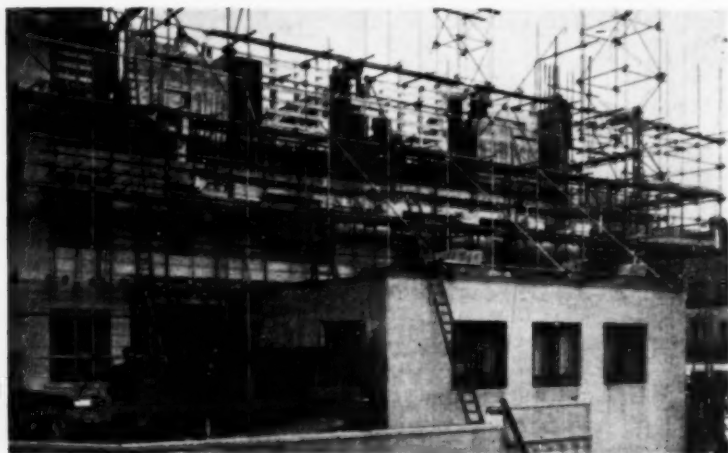


Fig. 2.—Work between Second and Third Floors.

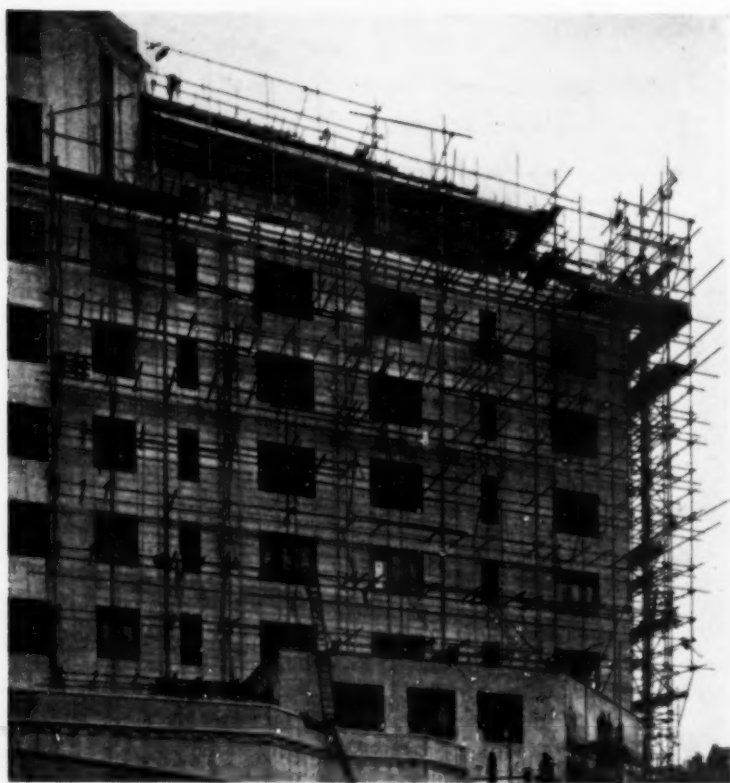


Fig. 3.—Photograph taken Eleven Weeks after that in Fig. 2.

comprise a reinforced concrete core 5 in. thick with 2 in. of cork on the inner face and terrazzo slabs 2 in. thick on the outer face. This is the same form of construction as in the main hotel, except that in the main building the reinforced concrete core is 7 in. thick. The new side walls act as girders which span from the end wall of the existing wing for a distance of about 42 ft. to the main columns, and cantilever beyond them about 18 ft. to the end wall of the extension. The side walls were built two stories high and were designed in the first stage to carry two floors of the extension before the supports were removed. As each floor was added and the height of the wall increased, the tensile stress in the main bottom reinforcement also increased progressively but to a diminishing extent. In these side walls the presence of large window openings caused concentrations of high shear stresses.

The new side walls commenced at second-floor level, which was the level of the roof of the existing building, and provision was made to avoid the load from these walls bearing on the existing work by forming a space between the roof and the bottom of the wall which was subsequently filled with compressible expansion-joint material. The main column on the south was positioned at second-floor level in the manner described, but it was not possible for this column to be vertical as it would have obstructed the main aisle in the garage below. This column therefore slopes at an angle of about 1 in 4½, thereby exerting a thrust on the existing hotel. On the north side the main column is not directly under the side wall, and a large beam was introduced at third-floor level to carry the load of 543 tons from the wall for a distance of about 1 ft. 1 in. to the centre of the new column extending a height of 55 ft. from the basement floor. To avoid eccentric loading on this column a hinge was introduced below the main transverse beam so as to ensure that all the load on the main column is truly concentric. The column is the shape shown in *Fig. 1* to enable certain obstructions to be avoided and to preserve an existing window-opening. *Fig. 4* shows the sloping column.

The existing roof at second-floor level was designed for normal roof loads and the stresses, when calculated for the floor-load plus the weight of partitions,



**Fig. 4.—Part of Sloping Column.**

proved to be somewhat excessive. Hangers were introduced on the line of the new corridor partition walls, and these were extended up to the new third-floor cross beams. These hangers were stressed by hydraulic jacks and the nuts then tightened. In this way an upward deflection of the existing second-floor beams was obtained and the extra load on the second floor is shared between that floor and the new third floor which was designed accordingly.

At seventh-floor level the walls are set back on three sides of the extension, forming a penthouse of two stories. The walls are of similar construction to those below and are carried on cross-beams at seventh-floor level. The penthouses are to be used as residences and are provided with a roof-garden having two fish-pools. The eighth floor and roof are of reinforced concrete hollow construction; they are 14 in. deep and span 33 ft. with ribs at 2 ft. 6 in. centres and a top slab 2 in. thick.

The concrete throughout the work was a

1:1½:3 mixture and had an average compressive strength at 28 days of 5530 lb. per square inch. The design is in accordance with B.S. Code of Practice No. 114 (1948). The work was commenced in September, 1952, and the whole of the structural work was completed during the first week in February, 1953. In view of the very restricted site and the difficulties in unloading and storing materials and mixing the concrete,

this work was an outstanding achievement in speed of construction in reinforced concrete. Figs. 2 and 3 illustrate the rapid progress made in the construction of the reinforced concrete work.

The architects are Messrs. Curtis Green, Son & Lloyd, the structural engineers are Considère Constructions, Ltd., and the contractors Sir Robert McAlpine & Sons, Ltd., all of whom were responsible for similar work in the main hotel.

## Reconstruction of a Railway Station at Sheffield.

THE roof over the main-line platforms of Victoria Station, Sheffield, is being rebuilt after the collapse in 1951 of four trusses at the western end of the station. The new work incorporates seventeen prestressed precast beams spanning across the tracks and supported by existing walls at a height of about 26 ft., and carrying over the platforms glazed steel awnings. The beams are

cables each containing sixteen high-tensile wires of 0.276 in. diameter. The beams also contain twelve 0.276 in. untensioned wires, twisted in pairs, of which four are in the top flange and eight in the bottom flange. Between the flanges and at about 8 ft. centres are stiffening ribs, in the outer three of which at each end of the beam are cast sockets for the steel suspension rods of the awn-

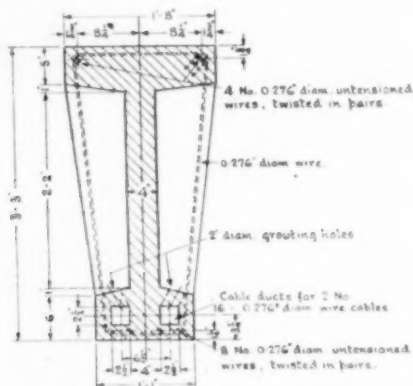


Fig. 1.—Cross Section of Beams.

at 25 ft. intervals and each weighs about 12½ tons. In addition to the awnings the beams are designed to carry overhead electrical equipment which will be required when the lines are electrified.

The beams are 87 ft. 9 in. long with a depth of 3 ft. 3 in. for a central length of 33 ft. reducing to 1 ft. 9 in. at the ends. The cross section is as Fig. 1 except for lengths of about 5 ft. at each end where the beam is rectangular. Each beam is prestressed by two straight

ings. The innermost suspension rod passes through a socket cast in the rectangular end-portions of the beams.

The design of the beams, which are prestressed by the Magnel-Blaton system, was carried out under the supervision of Mr. J. I. Campbell, M.I.C.E., Civil Engineer of the Eastern Region of British Railways. These beams are being made and erected by Messrs. Wellerman Bros., Ltd., and the remainder of the work is being carried out by Messrs. Samuel Butler & Co., Ltd.

## Gap-Graded Aggregates.

By J. D. O'KEEFFE, B.E.

AN investigation has been made on the effects of omitting material between  $\frac{3}{8}$  in. and  $\frac{3}{16}$  in. from the continuous type-gradings Nos. 5 and 6 given by Professor H. N. Walsh for  $\frac{3}{4}$ -in. gravel aggregate <sup>(1)</sup>. Two cement contents (about 520 lb. and 610 lb. per cubic yard) were used, corresponding roughly to 1:2:4 and 1:1½:3 concretes. The material below the gap was sand; that above it was

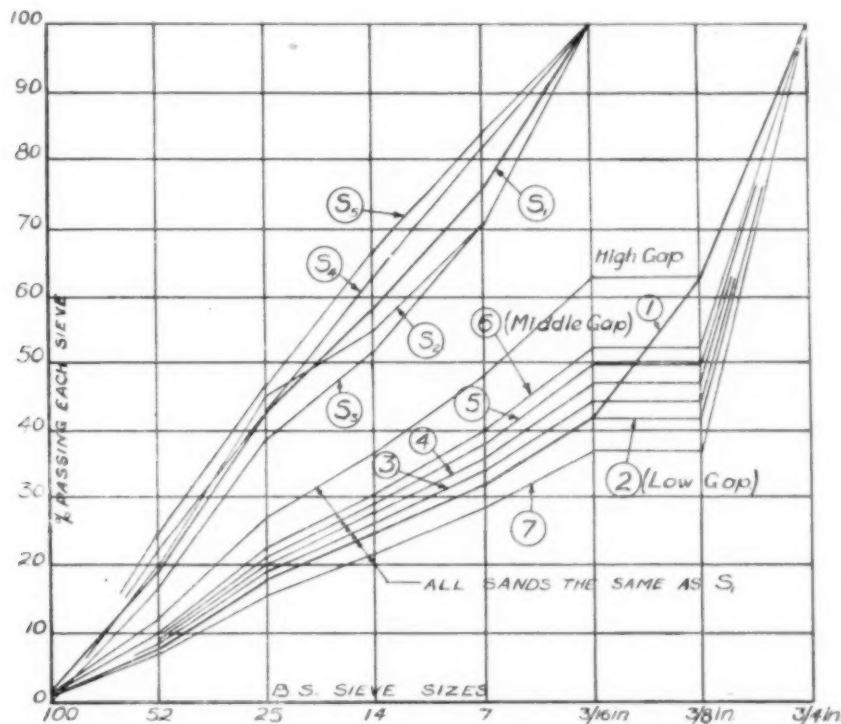


Fig. 1.—Gradings for Mixtures Containing 520 lb. of Cement per Cubic Yard.

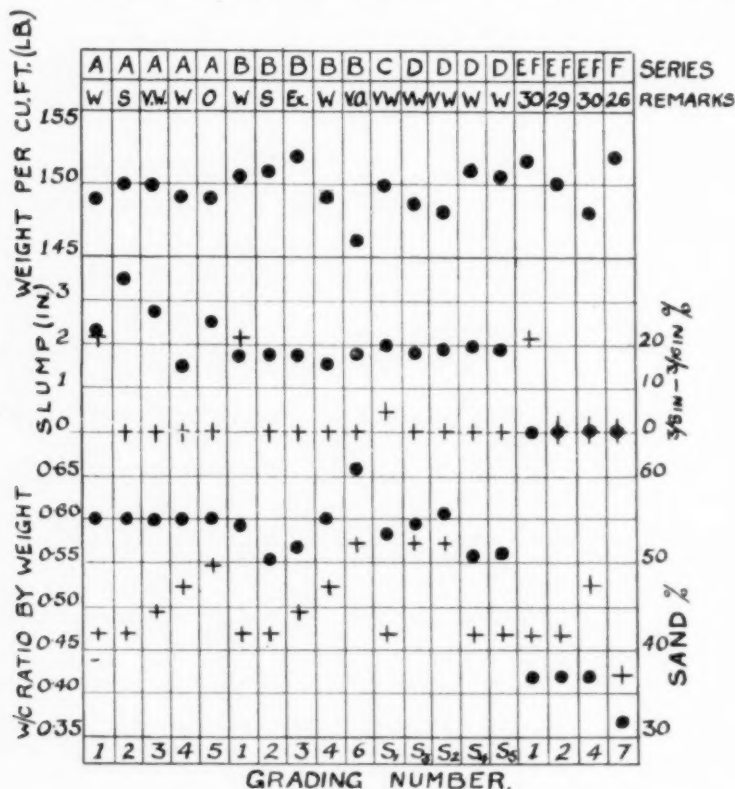
coarse aggregate. The aggregate was rounded limestone gravel with a small proportion of crushed gravel. A gap of this nature can be obtained by using a single size ( $\frac{3}{4}$ -in. to  $\frac{3}{8}$ -in.) coarse aggregate. A near-gap, that is when only a small amount of material of the gap size is present, may occur between  $\frac{3}{8}$  in. and  $\frac{3}{16}$  in. when fine and coarse aggregates are obtained separately. An account of naturally-occurring aggregate with a similar grading is given by I. E. Burks <sup>(2)</sup>.

<sup>(1)</sup> How to Make Good Concrete. Concrete Publications, Ltd. London.

<sup>(2)</sup> Concreting Methods at Chute-à-Caron Dam. Proc. Am. Conc. Inst., Vol. XXVI (1930), p. 330.

### Mixtures with a Cement Content of 520 lb. per Cubic Yard.

Grading No. 1 of Fig. 1 was continuous and was used as the control for mixtures with this proportion of cement. The cement-aggregate ratio was 0.16 by weight, corresponding roughly to 1 cwt. of cement to 6 cu. ft. of mixed aggregate. In each of the series of tests A, B, C, E, F, the grading of the sand (0 to  $\frac{3}{16}$  in.) was the same as in the control grading, but the percentage of sand was varied. The grading of the sand is shown in Fig. 1 (No. S<sub>1</sub>). The grading



The numbers refer to the gradings in Fig. 1. ● refers to the left hand scale; + refers to the right hand scale. W = workable; S = tendency to segregation; O = oversanded; V = very; Ex. = excellent workability; St. = stony; 29, etc. = time in seconds for initial compaction.

Fig. 2.—Properties of Mixtures Containing 520 lb. of Cement per Cubic Yard.

having 42 per cent. of sand (No. 2, Fig. 1) is termed a low-gap grading, that with 52.5 per cent. a middle gap, and that with 63 per cent. a high gap (Fig. 1). The results of the more interesting experiments are shown in Fig. 2.

**SERIES A. CONSTANT WATER-CEMENT RATIO OF 0.6.**—The percentage of sand in the aggregate was varied with the same sand grading. With this water-cement ratio the control grading produced a very good concrete. The mixture with a gap-grading and 44.6 per cent. of sand had the best workability, freedom

from segregation, and density. It was more workable and weighed 1 lb. per cubic foot more than concrete made with the control grading.

**SERIES B. CONSTANT SLUMP.**—The same gradings as in Series A were used, each mixture having just sufficient water to give a slump of about  $1\frac{3}{4}$  in. In series A and B less than 44.5 per cent. of sand led to segregation of the coarse aggregate, while more than 47 per cent. resulted in low density. The most workable concrete of this series had 44.6 per cent. of sand (No. 3, *Fig. 1*); it required  $3\frac{1}{2}$  per cent. less water than the control mixture for the same slump, and had greater density.

**SERIES C. NEAR GAP. CONSTANT SLUMP ( $1\frac{3}{4}$  in.).**—An attempt was made to reduce the tendency to segregation in the gap-graded mixture with 42 per cent. of sand by adding 5 per cent. of  $\frac{3}{8}$ -in. to  $\frac{3}{16}$ -in. material and reducing the amount of  $\frac{3}{8}$ -in. to  $\frac{3}{16}$ -in. material by the same amount. The resulting concrete was workable and not liable to segregate, as was the mixture with this proportion of sand in series B. The near-gap grading required 1.5 per cent. less water than that used in the control mixture.

**SERIES D. VARIED SAND-GRADINGS. CONSTANT SLUMP ( $1\frac{3}{4}$  in.).**—The sand grading was varied in the mixtures in which segregation occurred or which contained excess sand in series B, using the  $r$ -method and using values of  $r$  between 1.4 and 0.9<sup>(1)</sup>. The  $r$ -value is the ratio of the weight of material between each pair of consecutive sieves of the standard series to that between the next lower pair. Gradings other than those conforming to this system were also tried.

**Middle-Gap Grading.**—Various sands coarser than the control sand were tried to counteract the effects of the high proportion of sand. Gradings with 52.5 per cent. of sands  $S_2$  and  $S_3$  (*Fig. 1*) made concrete weighing about 148 lb. per cubic foot compared with 146 lb. per cubic foot for the middle-gap mixture of series B in which the control sand was used. These mixtures required about the same water content as the control mixture (No. 1, *Fig. 1*) for the same slump; with this percentage of sand a continuous grading would require more water.

**Low-Gap Gradings.**—Sands finer than the control sand and with  $r$  equal to 0.95 and 0.9 were tried to counteract the tendency to segregation. Mixtures with 42 per cent. of sands  $S_4$  ( $r = 0.95$ ) and  $S_5$  ( $r = 0.9$ ) gave satisfactory concrete with about 5 per cent. less water than the control mixture with the same slump.

**SERIES E. CONSTANT WATER-CEMENT RATIO. VIBRATED CONCRETE.**—A commercial vibrating table with a frequency of 3000 cycles per minute was used. Each batch was vibrated in a  $\frac{1}{2}$  cu. ft. bucket clamped to the table. Experience had shown that if the top surface became smooth and moist in about 30 seconds the compacted concrete would be satisfactory. This condition was called "initial compaction" and its formation in about 30 seconds was used as a criterion of ease of compaction. Using a water-cement ratio of 0.427 (needed by the control mixture for an initial compaction time of 30 seconds) with the various gap-gradings, only the concrete with 42 per cent. of sand was satisfactory. Mixtures with more sand had low densities.

**SERIES F. VIBRATED CONCRETE WITH CONSTANT TIME OF VIBRATION.**—In this series the proportion of water was that required to give an initial compaction time of about 30 seconds. The control mixture produced a denser con-

<sup>(1)</sup> The Grading of Aggregates and Workability of Concrete. By Glanville, Collins, and Matthews. Road Research Technical Paper No. 5. D.S.I.R.



crete than the low-gap grading. This is the reverse of what happened with the plastic concrete. Concretes with higher percentages of sand were unsatisfactory because of low densities. A mixture with 37 per cent. of sand had a higher density than the control mixture, and for 26 seconds' initial compaction time required 12.9 per cent. less water. This mixture had less sand than the nominal "low-gap" mixture. No segregation was noticed under laboratory conditions, but trouble might be experienced in practice with this amount of coarse aggregate.

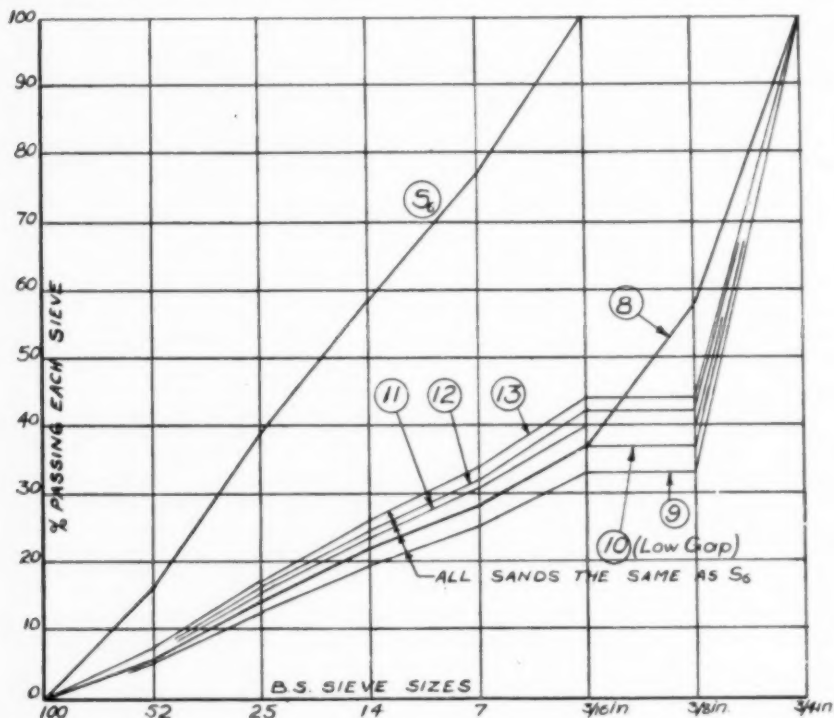


Fig. 3.—Gradings for Mixtures Containing 610 lb. of Cement per Cubic Yard.

Series E and F showed that for vibrated gap-graded concrete containing 112 lb. of cement to 6 cu. ft. of aggregate there should be between 37 per cent. and 42 per cent. of sand, depending on the shape of the coarse aggregate.

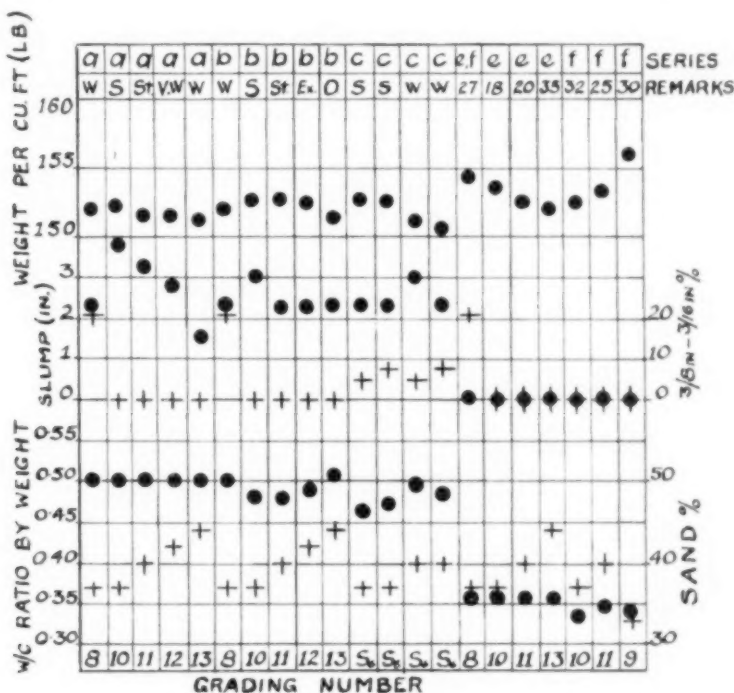
#### Mixtures with a Cement Content of 610 lb. per Cubic Yard.

The gradings were similar to those described but a different continuous control grading (No. 8, Fig. 3) was used which contained less sand and more  $\frac{3}{8}$ -in. to  $\frac{3}{4}$ -in. material than the previous control grading. The low-gap grading of this series contained 37 per cent. of sand. The grading of the sand in all the mixtures was the same as that in the control mixture and is shown in Fig. 3, No. S<sub>6</sub>. The cement-aggregate ratio was 0.186 by weight, corresponding to 1 cwt. of cement to 5 cu. ft. of mixed aggregate. Results of some of the tests are shown in Fig. 4.



SERIES a. CONSTANT WATER-CEMENT RATIO OF 0.5.—The continuously-graded mixture produced a good workable concrete which was a little stony. Gap-graded mixtures with less than 43 per cent. of sand were wetter than the control mixture. The most workable concrete had 42 per cent. of sand (No. 12, Fig. 3) but it was not quite as dense as that made with the control mixture.

SERIES b. CONSTANT SLUMP.—The slump was  $2\frac{1}{4}$  in. which was that of the control concrete having a water-cement ratio of 0.5. It was found that satisfactory concrete could be made with a sand content of between 40 per cent.



[See notes under Fig. 2. Gradings refer to Fig. 3.]

Fig. 4.—Properties of Mixtures Containing 610 lb. of Cement per Cubic Yard.

and 44 per cent. The concrete with 42 per cent. of sand (No. 12, Fig. 3) was excellent, requiring 2 per cent. less water than the control mixture and having a greater density; also it was more easily compacted.

SERIES c. NEAR-GAP GRADINGS. CONSTANT SLUMP ( $2\frac{1}{4}$  in.).—The  $\frac{3}{16}$ -in. to  $\frac{3}{8}$ -in. material necessary to prevent segregation in the low-gap grading produced a continuous grading. Concrete containing 40 per cent. of sand gave excellent results and required less water than the control mixture when 5 per cent. to 8 per cent. of  $\frac{3}{8}$ -in. to  $\frac{3}{16}$ -in. material was added. Mixtures C and c showed that the addition of a small amount of  $\frac{3}{8}$ -in. to  $\frac{3}{16}$ -in. material may reduce the tendency to segregation in some gap-graded mixtures or may improve the workability of stony mixtures.

**SERIES e. CONSTANT WATER-CEMENT RATIO OF 0.356. VIBRATED CONCRETE.**—The control mixture required a water-cement ratio of 0.356 for 30 seconds' initial compaction time. Using this water-cement ratio with the gap gradings, concretes with 37 per cent. to 40 per cent. sand reached initial compaction in 20 seconds or less. Concretes with higher percentages of sand were oversanded and had lower densities.

**SERIES f. VIBRATED CONCRETE OF CONSTANT TIME OF VIBRATION.**—Mixtures with 37 per cent. to 40 per cent. of sand required less water than the control mixture but their densities were lower, as in Series F. Mixtures suitable for vibration were obtained under laboratory conditions with 33 per cent. to 40 per cent. of sand. The mixture with the lower sand content had the greatest density (156 lb. per cubic foot) recorded in the investigation. The high proportion of single-sized stone might, however, cause trouble in placing the concrete in practice.

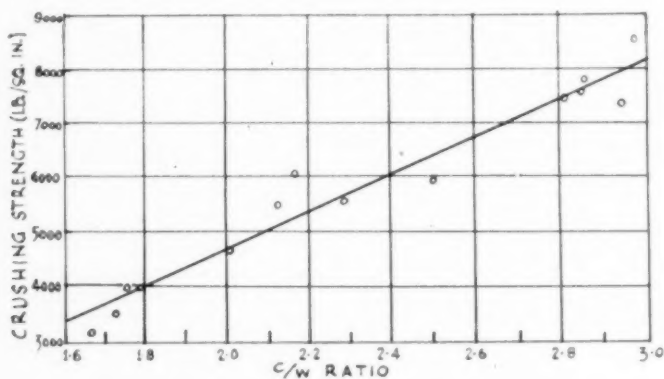


Fig. 5.—Strengths of 6-in. Cubes at Seven Days.

### Strength Tests.

The results of crushing tests at seven days on 6-in. cubes made with the concretes described are shown in Fig. 5. The strengths are plotted against the corresponding cement-water ratios rather than the water-cement ratios as this gives an approximately straight-line relationship.

**Conclusions.**—The tests show that for the  $\frac{3}{8}$ -in. aggregate used certain gap-gradings omitting  $\frac{3}{8}$ -in. to  $\frac{3}{16}$ -in. material may produce a concrete with better workability, density, and water requirement than a continuous grading. They show that care must be taken in choosing the proportion of sand, as a wrong choice may result in concrete liable to segregation due to an excess of coarse aggregate, or concrete which has a low density and high water requirement due to an excess of sand.

The experiments were carried out in the laboratory of the Department of Civil Engineering at University College, Cork. The author expresses his thanks to Professor H. N. Walsh for his guidance and help in the experimental work and in the preparation of this paper.

## A Large Gasholder Tank.

THE gasholder tank described is at the Stapleton Road, Bristol, works of the South-Western Gas Board. The gasholder is to be a four-lift, spirally-guided, all-welded, water-sealed structure. The tank is 232 ft. 2 in. internal diameter and 42 ft. 10 in. deep inside. The general details of the tank are shown in *Fig. 1*. Two valve-chambers were constructed monolithically with the tank. At the centre of the tank, support is provided for the post to carry a load of 210 tons.

The site rises steeply, and is partly on an old clay pit about 50 ft. deep which had been filled with ashes and town's refuse. Boreholes indicated that the filling existed to a depth of about 50 ft. below ground level and that there was a very hard compressed Keuper Marl rock formation below. The rock was nearer the surface on the northern side of the clay pits, but it was not expected that this stratum would be encountered within the area of excavation for the tank. Borings gave no indication of any standing water-table, and chemical analyses gave no indication of the presence of chemicals that would harm concrete. Subsequent experience, however, proved otherwise, and the borings actually gave a very unrepresentative picture of actual conditions.

A bearing capacity of about  $3\frac{1}{2}$  tons a square foot was required, and this could not be provided by the filling. The height of the tank and the fully inflated holder was about 216 ft. and, as a line drawn at 45 deg. to the horizontal from the ground-floor window of the nearest house had to pass over the top of the inflated tank, it was necessary to construct the tank in the ground so that the height above ground level was 175 ft. As the average depth to the marl was between 50 ft. and 55 ft. the top of the tank was at +9 ft. 6 in., the original average ground level being +18 ft. For about half of its perimeter the base bears directly on rock; for the remainder, plain concrete was placed below the base to a maximum thickness of 3 ft. The excavation was done in open-cut, the batters being generally 1 in 1, except that where the base was outside the old clay workings a much steeper gradient was permissible. The concrete was distributed by pump

because of the large amount required and the difficulty of access.

### Design.

Three methods of designing the wall were considered, namely, (i) With a "free" joint at the base, the whole of the hydraulic pressure from within the tank being resisted by ring tension; (ii) The wall to be monolithic with the base slab, the hydraulic pressure being resisted partially by ring tension and partially by the wall acting as a cantilever; and (iii) A prestressed concrete wall. Preliminary calculations indicated that the thicknesses of the base of the wall for these methods would be (i) 5 ft., (ii) 3 ft. 6 in., and (iii) 2 ft. plus the cover to the prestressing wires.

It was considered that a "free" joint at the base gave no advantage other than simplifying the calculations, and no further consideration was given to this type of construction. The saving in concrete and steel in a prestressed tank (iii) compared with a monolithic structure (ii) appeared to indicate that a fairly substantial saving in cost could be made by adopting a prestressed tank, but closer analysis showed that this was not the case. The most practical method of distributing concrete was by pump and it was considered that it would not be possible on this site to guarantee a strength at 28 days of 6500 lb. per square inch by pumping. In addition, a prestressed tank would not normally be asphalted internally, and it would be necessary to test the tank before backfilling. A prestressed tank would therefore have to be designed to resist full hydrostatic pressure with no relief from the active earth pressure, whereas in the case of a monolithic structure (ii) the inside of the tank would be asphalted and back-filling would be completed before the tank was filled with water so that allowance could be made for the effect of the active earth pressure. The maximum ring tension at the base of a prestressed tank would therefore be substantially greater, and, to obtain the precompression, with a sliding joint at the base, a total area of 2.75 sq. in. of 8-gauge wire per foot would be required. This would need 170 wires per foot and necessitate placing the wires in three or

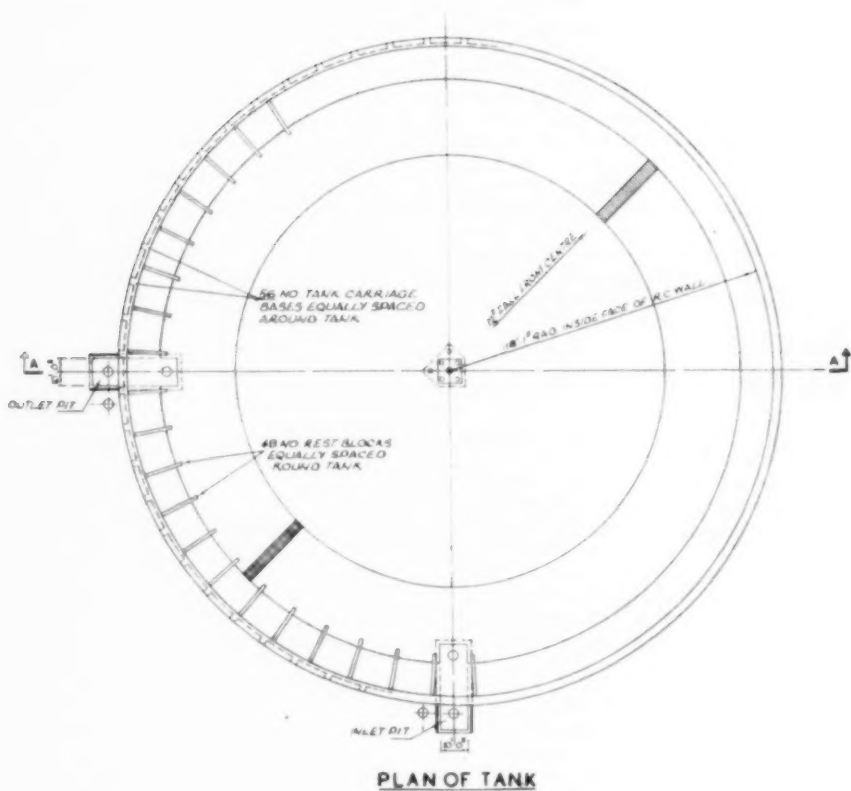
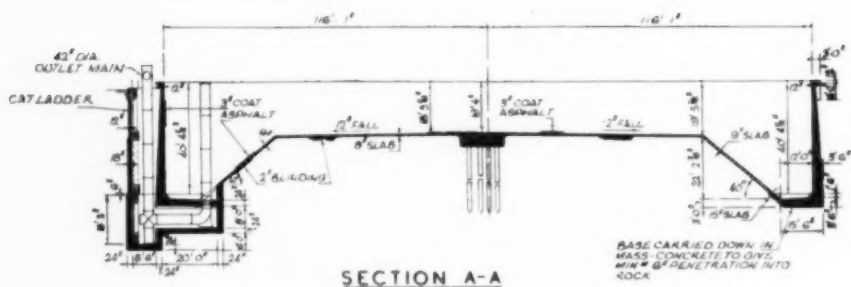


Fig. 1.

four layers at the base of the tank (the number of layers decreasing at intervals to the top), each layer being protected by a layer of gunite before placing the subsequent layers of wire. Furthermore, due to conditions on the site, it would have been uneconomical to handle shutters of sufficient strength to enable the full height of the wall to be concreted as a continuous operation in segments, and therefore some form of vertical prestressing would be desirable. Allowing for these factors, it was found that a prestressed tank showed no saving in cost compared with a reinforced concrete tank, and a reinforced concrete tank with the walls monolithic with the base (ii) was built.

The design followed generally the Recommendations for Liquid Retaining Structures of the Institution of Civil Engineers, but slight increases in the stress in the steel and of the net tensile stress in the concrete due to direct forces were allowed, because (a) the tank would be founded on rock, (b) no difficulty was expected in producing concrete with a minimum strength at 28 days of 3500 lb. per square inch, and (c) vibrators would be used, and care taken to ensure that shrinkage was small.

The maximum stresses used were: Steel, 14,000 lb. per square inch in direct tension and bending on the water-face and 18,000 lb. on the remote face; concrete in compression, 850 lb. per square inch due to bending and 600 lb. due to direct forces; concrete in tension, 250 lb. per square inch due to bending, and 200 lb. due to direct forces calculated on the composite section.

The wall was designed in accordance with the method of Dr. Reissner. Due to the monolithic construction the deflection of the wall under hydrostatic pressure is restricted at the base and bending moments are produced, the wall tending to act as a propped cantilever due to ring tension higher up. Progressing upwards from the base, the bending moment, which is negative at the base, reduces rapidly to a point of contraflexure, a positive moment then developing and being greatest at about the point of maximum ring tension and producing tensile stresses in the outer face. The ring tension increases fairly uniformly from the top to a maximum at a depth depending upon the ratios of the height of the wall to the diameter of the tank and

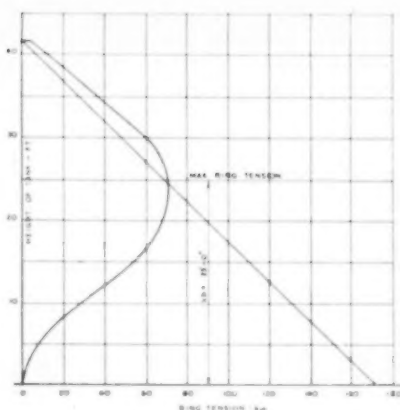


Fig. 2.—Variation of Ring Tension with Height of Wall.

the thickness of the wall. The maximum ring tension, its position, and the maximum negative moment at the base may be expressed in terms of parameters obtained from Dr. Reissner's analysis, allowance being made for the taper of the wall. The maximum ring tension is 25 ft. from the base (Fig. 2) and, allowing a relief from the active ground pressure of 27 lb. per foot of depth, the maximum ring tension required 4.9 sq. in. of reinforcement per foot of height. The tensile stress in the composite section was then 193 lb. per square inch or 202 lb. per square inch, dependent upon whether the modular ratio is assumed to be 15 or 12. From this point the direct tension decreases at a reasonably uniform rate to the top and bottom of the wall.

The bending-moment diagrams for the combined effects of water pressure and earth pressure, and for earth pressure alone, are given in Fig. 3. Steel is provided vertically to resist these moments together with certain additional moments from the holder, which are referred to later. Sections showing the reinforcement are given in Fig. 4.

Around the top of the tank are 56 anchor-blocks which carry the spiral guides of the holder. When the holder is inflated, wind will cause horizontal shearing forces to act on these blocks, together with downward forces on the leeward side and upward forces on the windward side. The point of application of the vertical forces is 15 in. inside the tank. Due to

the thickness of the wall it was assumed that the moments produced by the vertical forces from the guides would be distributed over a length of wall equal to the distance between the anchor-blocks. As the tank is fully buried in the ground, no special measures were taken to resist the horizontal shearing forces from the spiral guides, as it was considered that these forces would be resisted by the passive ground pressure. In addition, the balcony beam at the top of the tank was reinforced to form a stiffening rib.

At the base of the tank, 48 rest-blocks are spaced equally around the circumference to carry the steelwork of the holder when it is partially or wholly

deflated. The maximum load per block is 28 tons. The slab is designed to spread this load more or less uniformly over the base. The maximum ground pressure assuming the base to be 14 ft. wide and to cantilever from the wall, was 7840 lb. per square foot, which was satisfactory as the tank was founded on Keuper Marl. Adding the effects of the reaction of the ground and the downward loads gave the bending moments to be resisted by the footing.

As a precaution against unequal settlement due to the large difference between the load at the base of the tank and that at the valve-pits, additional shear bars are placed in the walls of the valve tunnel.

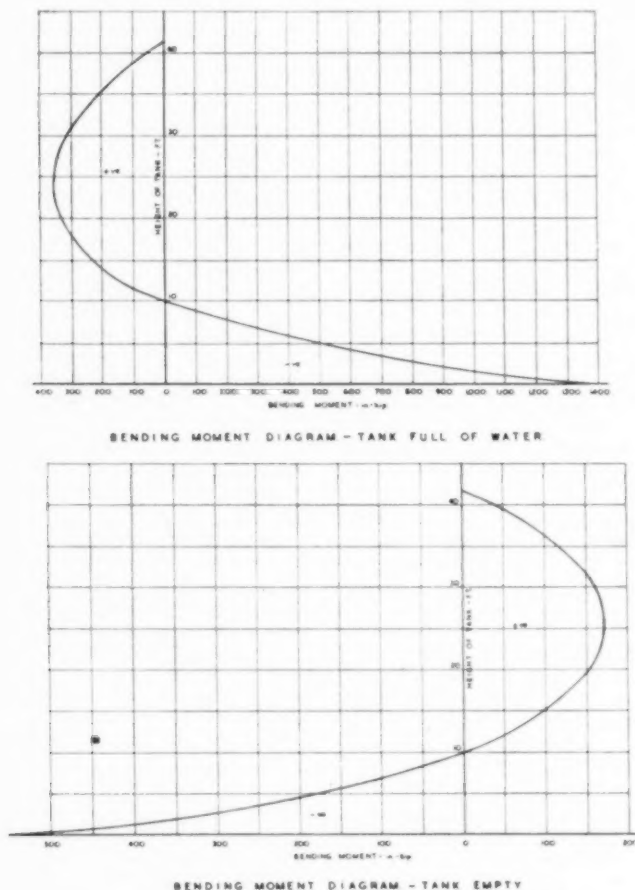


Fig. 3.—Bending Moments on the Tank Walls.

Consideration was given to welding the circumferential reinforcement in the wall of the tank. This would have saved 12 tons of steel. Due to other commitments, however, the contractor was not able to provide welders and the cost of employing a sub-contractor was, in this case, greater than the saving in reinforcement.

#### **Foundation of Centre-Post.**

The original design of the centre-post foundation utilised a circular reinforced concrete caisson to transmit the load of 210 tons to the Keuper Marl, which was estimated to be 28 ft. below "dumping" level. However, due to the presence of water in the subsoil, and to the fact that piling equipment and material were available from an adjoining site, it was decided to drive five concrete piles of 1 ft. 6 in. diameter and form a pile cap 3 ft. thick to carry the load. The estimated length of the piles was 24 ft., but all the piles reached a set at 13 ft. below dumping level. In view of the difference between the estimated length of the piles and the actual length it was decided to drive four test piles to ascertain the rock formation at a distance of 20 ft. from the centre of the pile cap. Those on the north, south and east axes indicated a reasonably level rock stratum. The pile driven on the west side reached a set at 25 ft. 6 in. below the dumping, and a pile driven 10 ft. from the centre of the cap on the western axis reached a set 21 ft. below dumping level. In view of the doubtful bearing strength of the structural pile driven on the western axis two more piles were driven 4 ft. from this pile on the N.W. and S.W. axes of the cap. These reached a set at 13 ft. 6 in. and 19 ft. respectively below dumping level, and were later incorporated as load-bearing piles in the cap.

#### **"Dumping" Slab.**

To simplify the erection of the steelwork for the holder, the dumping slab was required to be as large as possible. The original specification required the slope from the main channel, accommodating the shell of the holder, to the central dumping to be at 60 deg. to the horizontal. At the request of the contractor, this was reduced to 40 deg. to avoid having to use an outer shutter. No

great difficulty was found in placing concrete at this slope (*Fig. 5*), but where practicable it would no doubt be preferable to have a slope of 35 deg. or less. The main dumping slab is 8 in. thick and is reinforced with a light mesh in each face. Shrinkage was reduced by careful selection of the sequence of concreting the panels of the slab.

The specification required that the work should conform to the following dimensional tolerances: Diameter of the tank,  $\pm \frac{1}{2}$  in.; Level of the rest blocks,  $\pm \frac{1}{4}$  in.; Plumb of wall,  $\pm \frac{1}{4}$  in.; Positions of anchor blocks,  $\pm \frac{1}{4}$  in.; Distance between anchor blocks and rest blocks,  $\pm \frac{1}{4}$  in.

#### **Excavation.**

The material excavated down to dumping level was 76,000 cu. yd.; standing water was found 4 ft. below dumping level. It was thought that this was surface water which had collected in the clay pit, and two shafts were sunk 6 ft. into the foundation rock to form collection chambers from which to pump the water. As it was impracticable to use a well-point system, the water, the source of which was later found to be springs coming through the rock surface, was taken by channels to sumps on the south side outside the perimeter of the tank and then pumped to a settling-tank at ground level, from which it flowed by gravity into the sewer. The water-level was lowered 22 ft. to the rock but a continuous flow of about 10,000 gallons per hour was maintained and this rate of pumping continued during the construction of the tank.

During the excavation of the de-watering shafts it was noted that the water flowed into the pit in surges which were accompanied by obnoxious smells. This was due to the release of pockets of gas from the decayed vegetation in the surrounding "fill" and it was necessary to pump air to the men excavating the shafts.

While excavating the trench for the retaining wall on the northern perimeter it was found that the presumed boundary of the rock which had been traced by a survey actually extended the full width of the trench and commenced at a level just below the dumping. This rock had to be removed by blasting which was carried out on an 8-ft. face in two steps,



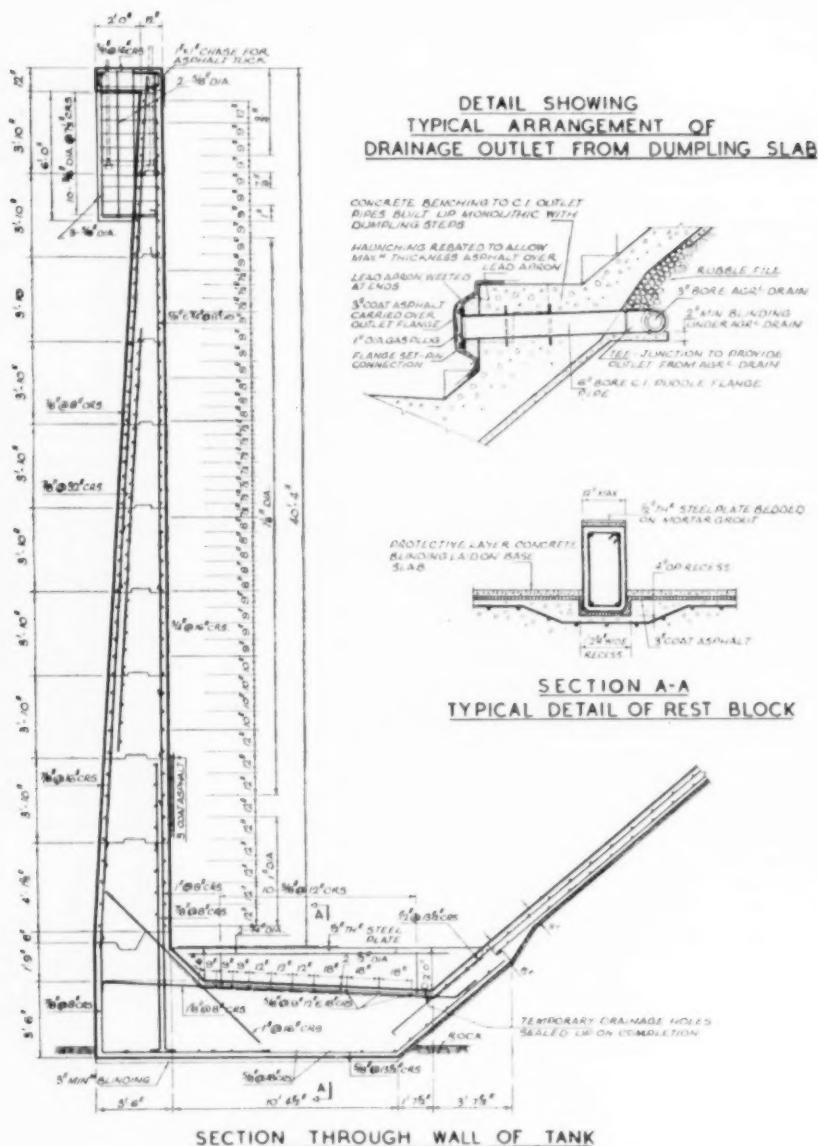


Fig. 4.—Details of Reinforcement in the Wall.

the centre being worked in advance of the sides. Holes were drilled to a depth of about 4 ft. and each charged with 1½ lb. of plastic explosive. It was usual to fire a series of eight charges with a short interval between firing each charge, using cordite fuse and amatol detonators. No blanketing mat was necessary for these operations.

#### Protection against Sulphates.

In the S.E. area of the site a white precipitate formed on the surface of the

bituminous membrane on the wall, and the joint sealed with two coats of bitumen, as it was not possible to apply bitumen to this concrete due to the presence of water; (d) The walls of the valve-pits which were exposed to the atmosphere were lined with asphalt on the faces in contact with the earth filling. The probable reason for the increase in sulphate content was oxidation of some of the filled material following excavation.

Due to the position and level of the main-line railway in relation to the



Fig. 5.—Construction of the Dumping Slab.

blinding concrete, and on the surface of the ground after excavation discoloration appeared accompanied by obnoxious gases. The sulphate content of samples of earth and water showed a marked increase over that of the samples previously taken, and in view of the high sulphate content, (a) All concrete, including the blinding layers, had a minimum cement content of 1:6; (b) Where possible, all concrete in contact with the black earth filling or sub-soil water was given two coats of bitumen applied hot; (c) At the junction of the base of the retaining wall and the rock a fillet of high-alumina cement concrete was laid to form a seal with a lap of 1 ft. over the

bottom of the excavation, and the presence of sub-soil water, it was necessary to sheet-pile a length of 120 ft. of the trench. The general level of the rock was 3 ft. below the base of the retaining wall and a concrete filling (1:2:4 mixture) was laid to make up this variation, and also to fill the sump of an old pumping chamber into which spring-water was flowing through fissures in the rock. The setting of the concrete first placed was delayed, and a sample of the spring-water was found to contain bicarbonates which reacted with the  $\text{Ca(OH)}_2$  in the cement. The water was therefore kept away from the concrete until the final set took place, and additional sumps

and drainage channels were constructed to remove this water.

### Construction.

The base of the retaining wall was constructed as soon as possible behind the excavation of the ground. The first lift of the wall, for which a special set of shutters was made, was also completed for the full circumference and followed closely upon the construction of the base. It was possible at an early stage to back-fill to a height of 6 ft. The main wall was built in halves, in each case to the full height. This led to economical use of the shutters and reduced the amount of scaffolding required.

A 4-in. concrete pump driven by a 21-h.p. motor and an electrically-driven 21/14 closed-drum mixer with a raised discharge were installed. All materials were weigh-batched with a trolley batcher placed on an embankment so that lorries could discharge into chutes feeding the storage bins. All concrete was vibrated with electrically-driven immersion-type vibrators and hammers applied to the surface shuttering. The concrete was required to have a minimum strength of 3500 lb. per square inch at 28 days and it was found that a mixture of 448 lb. of limestone, 336 lb. sand, and 112 lb. of cement gave the required strength and workability. The slump was usually between 1 in. and 3 in. depending on the part of the work being cast and the arrangement of the pipe-line.

The pipe-lines were inclined downwards, which is normally to be avoided when using a concrete pump. The concreting of the upper lifts of the wall, which were above dumping level, needed particular care as the pipe-line inclined downwards from the mixer to the dumping, and then rose to the point of discharge, thus forming a "trap" in the pipe-line. In order to overcome this difficulty a loosely-packed "paper dolly" was placed in the pipe and a mixture of sand and cement was pumped through the pipe before the concrete. The mortar lubricated the internal lining of the pipe and the "dolly" prevented separation of the mortar on the downward inclination, thus preventing air being sucked into the pipe and avoiding

air locks and blockages. From the pump to the rim of the excavation a slight rise in the pipe-line was maintained in order to keep the face of the piston fully charged with concrete. It was usual to terminate the pipe 10 ft. above the placing position and to distribute the concrete within the shutters by means of flexible "elephants' trunks". The concreting of the base was divided into 28 sections, each containing  $67\frac{1}{2}$  cu. yd. of concrete, this being assumed to be a day's work (the actual concreting time being about eight hours). The walls were cast in 4-ft. lifts; in the lower lifts of the wall 250 cu. yd. of concrete were placed in a working week of six days.

The sides of the dumping sloping at 40 deg. were concreted in sections about 12 ft. wide without a face shutter.

**SHUTTERING.**—There was about 7000 sq. yd. of shuttering to the wall of which 3400 sq. yd. had a sloping face. The shuttering comprised timber panels 4 ft. high with 8-ft. soldiers on curved steel walings. Each panel had a length of  $\frac{1}{8}$  of the circumference, the internal shutters giving a working clearance of  $\frac{1}{2}$ -in. in the length, and the external shutters, which were to a sloping face, to  $\frac{1}{8}$  of the least circumference. On the lower lifts the gap was made up by filler pieces which varied in width for each lift. In each lift, square nuts, with an anchor and anti-turning device of two straight lengths of square rod 4 in. long welded to each nut, were cast in the wall at a distance of 4 in. from the face. The shutters were hoisted by means of a fixed chain-block secured to the scaffold. Twenty-eight panels, covering half the circumference of the wall, were provided.

On the ninth and tenth lifts gaps were left in the concrete at positions where the groups of holding-down bolts for the bases of the gasholder roller-carriage were to be set. Later the bolts were fixed, using templates, and concreted in. The general contractors, who also designed the reinforced concrete, are Messrs. A. Monk & Co., Ltd., the contractor for the holder is the Oxley Engineering Co., Ltd., and the asphalt work was carried out by Highways Construction, Ltd.

## Precast Buildings in Eire.

PRECAST concrete members have been used for the framework of new tarehouses erected at three of the factories of the Irish Sugar Co., Ltd. (Tarehouses are buildings in which the tare and sugar content of each load of sugar-beet are measured.) The design of the frames is unusual as the roof members are pin-jointed at the tops of the columns, which therefore act as cantilevers to resist the horizontal thrust from the members. The frames are shown in *Fig. 1*.

### Precast Members.

The frames (*Fig. 2*) are at 13 ft. 4 in. centres for a span of 29 ft. 5 in., the roof having a rise of 10 ft. The cross section of the rafters is 9½ in. by 6 in. and they are

haunched at the apex. Projections, 3½ in. by 3 in., are provided as seats for the purlins, which are also of precast concrete.

The columns (*Fig. 4*) are tee-section, 14 ft. 6 in. long, with a recess formed at the top in which the roof members are bolted. The purlins are 13 ft. 3¼ in. long by 6 in. by 3 in. and are connected to the rafters by ¾-in. diameter bolts passing through ¼-in. steel plates. The foundations for the columns, 5 ft. 6 in. long by 3 ft. wide, were cast three weeks before the erection of the columns, which were placed eccentrically on the foundations. The main reinforcement in the columns projects at the bottom (*Fig. 4*) and is welded to the same number of bars pro-

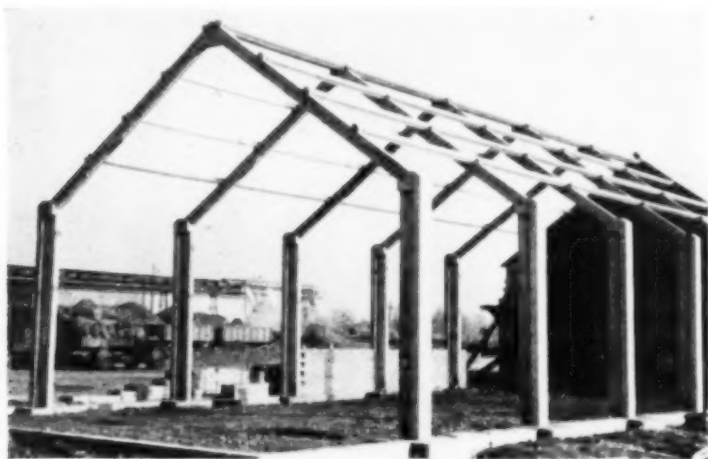


Fig. 1. Partially-erected Frame.

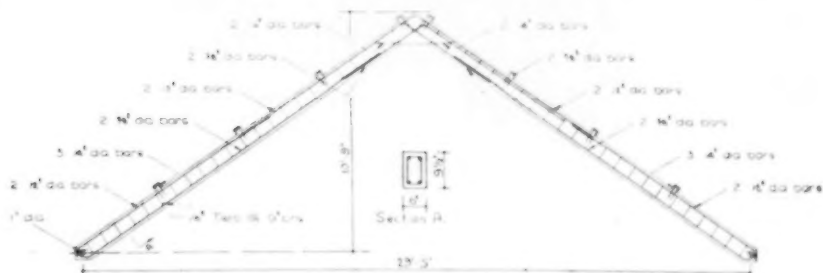


Fig. 2. Details of Roof Frame.

jecting from the in-situ foundation (Fig. 3). This reinforcement is then encased with a 1 : 2 mixture of mortar, thereby ensuring continuity between the columns and the foundations.

The roofs are covered with asbestos-cement sheets fastened to the purlins by hook-bolts. The external walls are of 9-in. concrete blocks.

The concrete for all the members is a 1 : 1½ : 3 mixture with aggregate of ¾ in. maximum size for the roof members and ¾ in. for the columns. The concrete was vibrated by portable external vibrators. The water-cement ratio was 0.43 and crushing strengths of about 6500 lb. per square inch were obtained on cubes at an age of 14 days. The roof members and the columns weigh about 1 ton each, and the purlins 2 cwt. The reinforcement was welded in cages before it was placed in the moulds.

### Erection.

The members were cast at a works and transported to the sites by lorries. They were erected by a 10/RB crane. The order of erection was first to place the columns on the foundations and temporarily shore them. The roof frames were then placed in position and bolted to the columns, after which the eaves purlins were bolted to the frames. The columns were then aligned and the reinforcement projecting from the base of the columns was welded to that projecting from the foundation, after which the joint was concreted. The other purlins were then placed followed by the asbestos-cement sheets.

Holes were formed in the rafters from which 4-in. by 2-in. timber joists could be supported to carry ceiling joists to which were nailed insulating boards. The finished ceiling therefore conforms in shape to the outline of the roof frames.



Fig. 3.—Joint between the Reinforcement of the Columns and the Bases.

### Design.

The members were designed by Mr. P. J. Carroll, M.E., A.M.I.C.E., engineer of the Irish Sugar Co., Ltd., and follow the principles set out by him in "The Factor of Safety as Applied to Reinforced Concrete Design," published in the November, 1951, number of the Journal of the Institution of Civil Engineers. In this paper it is stated that, provided deflection is

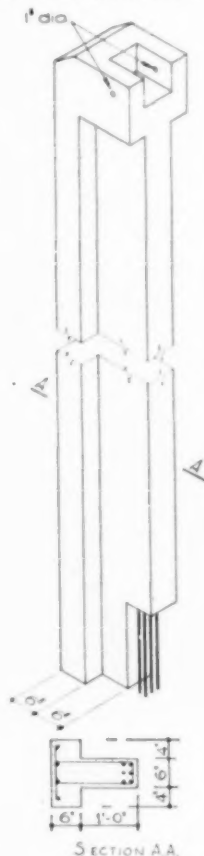


Fig. 4.—Details of the Columns.

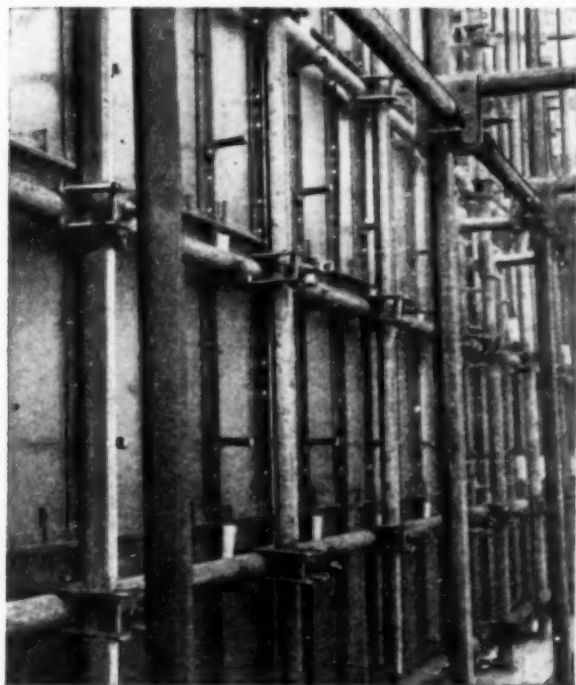
not of great importance, the members need be designed to carry only a proportion of the dead load (in this case 68 per cent.) together with the full imposed load. This results in a considerable reduction of the sizes of the members in cases where the ratio of the dead load to the imposed load is large.

# STEEL FORMS

The Multiple System of Interlocking

## STEEL SHUTTERING

for in-situ concrete construction



### GUARANTEED HAND RIVETED CONSTRUCTION THROUGHOUT

ENORMOUS STRENGTH ALTHOUGH LIGHT IN WEIGHT

ENGINEERED WITH ACCURACY AND PRECISION

BUILT LIKE A SHIP FOR ENDURANCE

EACH UNIT A COMPLETE ASSEMBLY

NO LOOSE PARTS — LOW MAINTENANCE

POSITIVELY NO WELDING

YEARS OF HEAVY USAGE

**A. A. BYRD AND CO., LIMITED**

210, Terminal House, Grosvenor Gardens, London, S.W.1

'Phone: SLOane 5236.

'Grams: Byrdicom, Wesphone, London.

# "Ritecure"

THE RIGHT CURE FOR CONCRETE

## MEMBRANE CURING

for horizontal and vertical surfaces

### "RITECURE"

#### MEMBRANE CURING

#### Further Notable Points

- RITECURE reacts with the calcium radical to aid in producing the tough, impervious, adherent film.
- RITECURE increases the abrasive resistance and ultimate durability of the concrete surface.
- RITECURE, colourless and non-staining, contains a temporary green indicator. This colour disappears in a day or two.



This illustration shows part of several miles of concrete kerbing on which "RITECURE" was used. Note the simple and one-man operation, and the absence of covering materials. This work was carried out by the County Council of the West Riding of Yorkshire. County Engineer: Mr. S. Maynard Lovell, O.B.E., T.D.

RITECURE is sprayed on the concrete surface and forms a cellophane-like skin which ensures the retention of the maximum amount of moisture in the concrete. It has been effectively and economically used on over eight million yards of roads, runways, floors, cooling towers, and other structures in this country and for many million yards of concrete abroad in extremely high and low temperatures and varying climatic conditions. Its use is backed by a highly skilled Technical Service with an extensive experience in concrete curing. For full details, send to:

# STUART B. DICKENS, LTD.

88 VICTORIA STREET,

WORKS: OLD MILTON STREET,

LONDON, S.W.1.

LEICESTER.

TELEPHONE: ABBEY 4000

TELEPHONE: LEICESTER 20390



## Thin Concrete Walls and Roofs.

### GUNITE ON BAMBOO AND WIRE-MESH REINFORCEMENT.

We have received the following notes on the use of thin concrete walls and roofs in India from Mr. M. R. Venkataram, chief engineer of the Western Railway of India. A similar form of construction was described in this journal for October, 1952.

In the year 1948, in the area of the

these cracks could have been prevented if steel nails had been partly driven into the sides of the posts and bonded in the gunite.

Other buildings have been constructed in which bamboo reinforcement was replaced by 17-S.W.G. steel wire or by 2-in.



Fig. 1.—Residential Flats at Bombay, India.



Fig. 2.—Western Railway Station, Surat, India.

Western Railway of India, small dwellings were constructed of gunite, 2 in. thick, on thin bamboo reinforcement tacked on in diamond formation to wooden posts and walings to form the walls; the roof was of asbestos-cement sheets on wooden rafters. An office building and several other buildings of the same construction have withstood five monsoons with rainfalls of over 80 in. and including cyclones. They are still in excellent condition although hair cracks have appeared in the concrete at the wooden posts due to lack of adhesion. It is thought that

wire mesh tied on to frames of  $\frac{3}{4}$ -in. diameter bars, all of which were embedded in 2 in. of gunite to form the wall panels. The vertical bars at the edges of the frames formed the reinforcement of the columns. These buildings have withstood three monsoons with over 100 in. of rainfall; at one time the rainfall was 30 in. in 24 hours.

To avoid having to take the gunite equipment to each site, and also to reduce shrinkage after erection, the members were precast. Single and multiple-story buildings with flat roofs have been con-

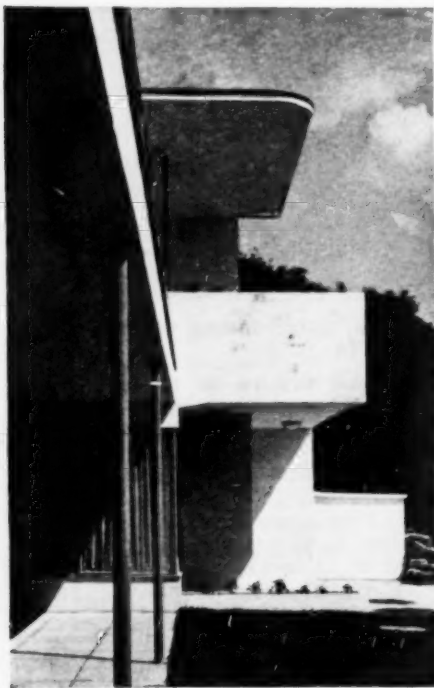
structed with precast members. The wall panels are 2 in. thick and the columns were either cast in a single length for each story or made of hollow members each 1 ft. deep. The columns have grooves in which the wall slabs were placed, bedded in mortar, and grouted. The beams were also precast. The roofs comprise precast slabs from 2½ in. to 3 in. thick, laid on ledges formed in the beams, and with bars projecting into 1½ in. to 2 in. of concrete laid in situ. Fig. 1 shows a block of flats and Fig. 2 the station buildings at Surat constructed in this manner. Where climatic conditions are extreme, hollow walls with an air space of 2 in. between the leaves have been found adequate. The slabs are cast on a concrete platform which is oiled, giving a smooth surface to the slabs and obviating the need for internal plaster in the Indian climate.

The concrete mixture was 1 : 4 for the roof and load-bearing members and 1 : 6

for the walls. Tests indicate that both the roof and wall slabs are very strong and have a factor of safety of six. The design stresses adopted were 1000 lb. per square inch compression in the concrete and 18,000 lb. per square inch tension in the steel.

The cost of these houses compared with conventional types of single-story houses is 20 to 25 per cent. less for the single-wall types and about 12 to 13 per cent. less for the hollow-wall types. In the case of multiple-story dwellings the saving compared with conventional construction varies from 10 to 30 per cent. Large station buildings, offices, and warehouses have been built by these methods on this railway.

Mr. M. R. Venkataram, whose address is General Office, Western Railway, Churchgate, Bombay, India, informs us that he will be pleased to send to those interested full information on the methods he has developed (which have not been patented).



## A better surface at less cost

Masonite Tempered Presdwood as a form-lining produces a smooth, flawless, and dense surface; concrete requires no further treatment after forms are removed. **Masonite Tempered Presdwood** is Grainless Wood specially impregnated for heavy duty; since 1930 it has been used successfully for shuttering on contracts of all kinds. Ten to fifteen uses are common. It is easy to work on site, does not corrode or leave unsightly marks or stains; it is flexible and ideal for shuttering to curved work.

Registered Trade Mark



## Tempered Presdwood

HAS BEEN USED AND PROVED  
FOR 20 YEARS

Write for illustrated Technical Catalogue.

**Masonite Ltd.,** Bevis Marks, London, E.C.3  
Avenue 2846

**STRONGER AND BETTER CONCRETE**  
with the **NEW**

# Winget

## 'VIBROCON'

### VIBRATING SPADE



**13,000 Full Impulses per minute from  
the Model 55**

**9,000 Full Impulses per minute from the  
larger Model 70**

On jobs demanding vibration methods the higher frequencies of Winget 'Vibrocon' Vibrating Spades give swifter compaction to maximum density. The workability of harsh mixes is increased and thorough consolidation can be achieved in 30 seconds. Use Model 70 (2½" dia.) for mass concrete and Model 55 (2.1/10" dia.) for closer reinforcement on smaller sections. There are no gears or belts and operation is extremely simple. Choice of three drives—Petrol, Electric or Pneumatic.

*Greater strength. Greater density and homogeneity. Less shrinkage. Greater resistance to frost. Better bond between concrete and reinforcement. Better bond at construction joints.*



# Winget

CONTRACTORS' PLANT SPECIALISTS

WINGET LTD ROCHESTER  
KENT ENGLAND

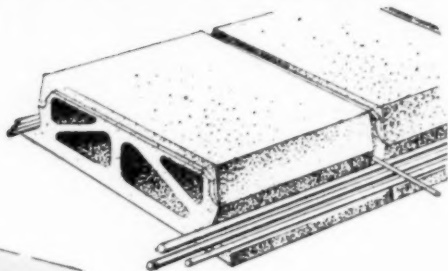
Tel: SRoad 7276 (3 lines) Telegrams: Wingetum Rochester



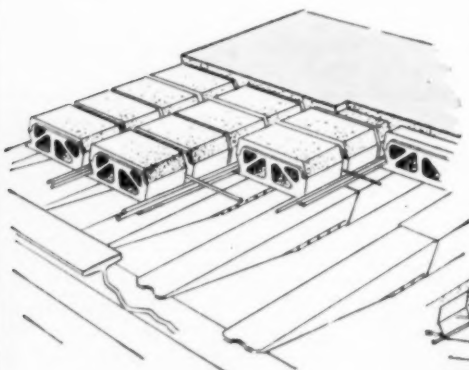
# SMITH'S

## FIREPROOF FLOORS

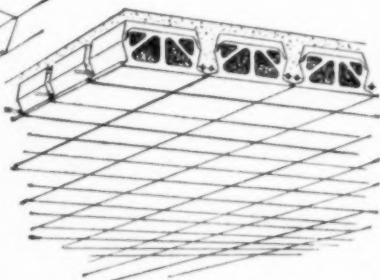
The most adaptable System of  
Suspended Hollow Concrete  
Floor and Roof Construction  
for large and small spans.



Showing Two-way Reinforce-  
ment and Hollow Concrete  
Blocks laid on Trianco Tele-  
scopic Centers.



Showing uniform concrete soffit.  
Obtained without use of slip tiles.



**2 WAY REINFORCED  
SUSPENDED  
CONCRETE FLOORS**

The Two-way Reinforced Floor for  
distribution of point loads with  
efficiency and economy, employing  
the original system of steel Telescopic  
Centers.

SMITH'S FIREPROOF FLOORS LTD  
IMBER COURT • EAST MOLESEY • SURREY  
EMBerbrook 3300 (4 lines)

## Book Reviews.

**"Prestressed Concrete."** By Kurt Billig. (London: Macmillan & Co., Ltd. 1952. Price 36s.)

THE arrangement of this book is similar to that by the same writer published in 1944. It is divided into three sections, the first dealing with the development of prestressed concrete and describing many of the systems in use, the second describing methods of analysis, and the third giving examples of the design of structures.

The most successful part of the book is the first section in which the most important applications are briefly, but adequately, described. The chapters which follow, under the heading "Design", deal entirely with the stress analysis of a section. There is no development of a method leading logically from the calculation of the bending moment to the dimensioning of a member. Nor, for the cases in which curved cables are used, is a method given for determining quickly the shape of the cable when its maximum eccentricity has been calculated. It is stated that the maximum value of the shearing stress is unaltered whether the beam is prestressed or not, but there is no mention of the fact that, if the beam contains cables curved upwards towards the ends, the shearing force due to the load is reduced by the vertical component of the slope of the cable.

Among the examples are calculations for a transmission-line pole in the form of a tapering Vierendeel girder, and the design of a shell roof in which the slab, 1½ in. thick, is cast with longitudinal grooves, 1-in. deep, in which wires are placed and tensioned and the roof then covered with gunite.

**"Dimensionnement Experimental des Constructions."** By Manuel Rochoa. (Lisbon: Ministry of Public Works. 1952. No price stated.)

THIS is a review, in the French language, of the methods available for the design of structures based upon the behaviour of scale models. Mechanical similarity is considered for two cases, the one in which both model and prototype are of the same material and the other in which the materials differ. The construction of models, methods of applying loads or deflections, and of measuring deformations are discussed in detail and the advantages and disadvantages of various types of extensometers, including electrical resistance strain gauges, are described.

**"Architects' Detail Sheets."** Edited by Edward D. Mills. (London: Hiffe & Sons, Ltd. 1953. Price 25s.)

THIS book contains 96 scale detail drawings accompanied by photographs of portions of buildings completed during the last few years. The details have been contributed by architects in many countries and are a selection of those published since the year 1948 in "The Architect and Building News." Although the book is primarily of interest to architects the details of reinforced concrete work will be of value to engineers concerned with the structural design of buildings.

**"Funções Ortogonais na Resolução de Problemas da Teoria da Elasticidade."** By T. van Langendonck. (São Paulo: Portland Cement Association of Brazil. 1952.)

THIS is the first of two volumes of a book in the Portuguese language dealing with the solution of various problems in the theory of elasticity by the use of orthogonal functions. The general theory is introduced in the first chapter and the remainder of the book is devoted to the application of the method to problems of torsion on sections of various shapes including hollow sections and circular shafts of varying diameters.

**"Quality Concrete."** The Concrete Association of India. (Bombay: The Association. 1951. Price 7/8 rupees.)

IN the first four chapters of this book information is given regarding the manufacture of Portland and other cements, the handling and testing of cement, the types and quality of aggregates, the testing of aggregates, the testing of water for concrete, and the types and uses of admixtures. Various methods are described, suitable for large and small contracts, for proportioning mixtures. The chapter on control of the quality of concrete on the site is comprehensive and includes methods of transporting, placing, compacting and curing concrete as well as methods of sampling and testing. Appendixes include standard methods of making cube and beam tests, details of the effects of various substances on concrete, and notes on the Indian draft specifications for cements.

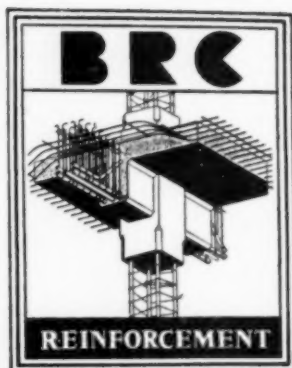
Generally the specifications and standards are those of the British Standards Institution but the methods of proportioning mixtures and site control are based on U.S.A. practice.

**Walls of Blocks and Slabs.**

CODE of Practice No. 122 (1952) "Walls and Partitions of Blocks and Slabs" has been issued (price 9s.) by the British Standards Institution. The materials dealt with in the code are blocks of clay, concrete, gypsum, anhydrite, and glass, and slabs of woodwool and plasterboard and plaster.

The recommendations for concrete blocks are the same as in British Standards Nos. 492, 728, and 834. In addition the code gives information regarding sound insulation, thermal insulation, fire resistance, the reduction of condensation, and the prevention of pest infestation. The causes of cracks and the precautions to be taken to prevent their formation are outlined.

In the section dealing with work on the site recommendations are made regarding the handling and storage of materials, methods of laying blocks, the provisions to be made for services and fittings, and the treatments commonly used at the heads of load-bearing and non-load-bearing walls and partitions.



**"CONCRETE SERIES"**  
**BOOKS ON CONCRETE**

For a complete catalogue giving prices in sterling and dollars, send a postcard to:  
**CONCRETE PUBLICATIONS, Ltd.**  
 14 Dartmouth St., London, S.W.1  
 England

# GUNITE SPECIALISTS

## WM. MULCASTER & CO. (CONTRACTORS) LTD.

We invite inquiries for Gunite Linings and Renderings  
 for new or old structures of every kind in any part  
 of the country.

**HASLINGTON**

**CREWE**

Telephone: Crewe 2265-6.



# SHUTTERING by SGB



*Circular Column with  
Mushroom Head*

**SGB contract service covers:**

**also SALE or HIRE:**

Bills priced at Tendering Stage  
MATERIALS & LABOUR supplied from  
commencement of contract to completion

TELECENTRES • SHUTTERING PLATES  
PROPS • COLUMN CLAMPS • BEAM  
CLAMPS • WALL BRACKETS

## SCAFFOLDING (GREAT BRITAIN) LIMITED

MITCHAM, SURREY • Telephone: MITCHAM 3400 (21 lines) • Telegrams: SCAFCO, MITCHAM

Branches at: ABERDEEN • BIRMINGHAM • BOURNEMOUTH • BRIGHTON • BRISTOL  
CAMBRIDGE • CARDIFF • DOVER • DUBLIN • DUNDEE • EDINBURGH • EXETER  
GLASGOW • HULL • LEEDS • LIVERPOOL • MANCHESTER • NEWCASTLE • NOTTINGHAM  
OXFORD • PLYMOUTH • PORTSMOUTH • SOUTHAMPTON • STOKE-ON-TRENT • SWANSEA

*-the originators of tubular scaffolding!*

Telephone your nearest  
SGB Branch NOW!



# "CONCRETE YEAR BOOK"

EDITED BY OSCAR FABER, C.B.E., D.Sc., M.Inst.C.E., & H. L. CHILDE

## 1953 EDITION

1068 pages . . Price 6s. ; by post, 7s. 2d. \$1.30 in Canada and U.S.A.

**HANDBOOK** In this Section no attempt is made at giving individual opinions, but to present in concise and convenient form specifications or methods which are either standard practice or recommendations formulated after thorough investigations by competent bodies. Complete memoranda and data of everyday use.

**DIRECTORY** The only complete Directory of the concrete industry, classified under different headings for ease of reference. Complete list of trade names and brands.

**CATALOGUE** Describes the businesses or products of more than 700 firms connected with or catering for the concrete industry. Invaluable to anyone seeking a firm of contractors to carry out special kinds of work, or a machine, material or product for any purpose.

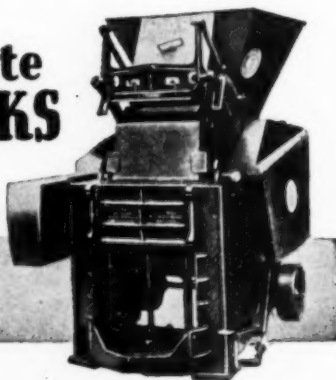
**Make sure of your copy now**

**CONCRETE PUBLICATIONS LIMITED**

14 DARTMOUTH STREET, LONDON, S.W.1

## High-pressure Production of Concrete BLOCKS

**TRIANCO**  
*Nº K'2 Type*  
BLOCK MAKING MACHINE  
*Power Operated  
Fully Automatic*



This machine is specifically designed for the mass production of SOLID BLOCKS and is capable of producing 300 blocks per hour, which are jolted, compressed and extruded automatically. Fitments are also available for the manufacture of hollow blocks.

*Full specification will be sent on application*

**TRIANCO**  
**BLOCK-MAKING MACHINES**

**TRIANCO LIMITED**  
IMBER COURT, EAST MOLESEY, SURREY  
Telephone: EMBerbrook 3300

## A Composite Tee-Beam Floor.

THE system of floor and roof construction shown in *Fig. 1* may be used for spans of moderate lengths for buildings for office or domestic use. It comprises precast concrete beams with a concrete slab  $1\frac{1}{2}$  in. to 2 in. thick cast in situ on a shutter of close-mesh light-weight expanded metal. Bond between the beam and the slab is obtained by stirrups which project through the mesh and are bent over to lie in the slab.

The construction of a floor supported by in-situ columns and main beams is shown in *Figs. 2* and *3*. The main beams are T-shaped, with a flange of the same depth as the precast beams. The ends of

the longitudinal bars in the precast beams project and are embedded in the flanges of the main beams. A timber nailing strip, which also forms the bottom of the mould, is attached to the underside of each precast beam to enable the ceiling to be fixed. After the shutters for the main beams are erected the precast beams are placed in position, supported on the shutters at their ends and by a central prop (*Fig. 2*). The main beams are then concreted, and later the expanded metal is placed in position and the slab laid (*Fig. 3*).

Where a floor is supported by walls, the

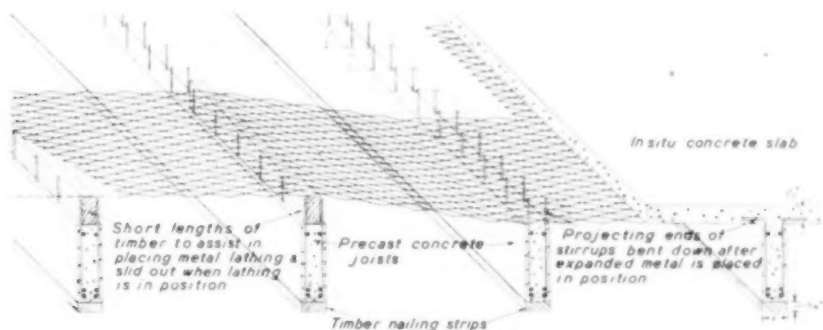


Fig. 1.



Fig. 2.—Precast Beams laid on Shutters of Main Beams.



Fig. 3.—Floor Ready for Laying Topping.

arrangement of the precast beams is the same as that for timber joists. The spacing of the precast beams can be varied to suit the dimensions of the floor and the load, but is limited by the type of ceiling to be provided. For a plasterboard ceiling the spacing is usually 1 ft. 6 in.

Where light-weight partitions have to be supported, two precast beams may be placed side by side. For spans up to 12 ft. the average cost, exclusive of the ceiling and floor or roof finishes, is 26s. per square yard. The system has been designed by the Expanded Metal Co., Ltd.

## SIMON-CARVES LTD

*Have additional vacancies for*

### DRAUGHTSMEN

*for*

STRUCTURAL STEELWORK • REINFORCED  
CONCRETE INDUSTRIAL STRUCTURES  
GENERAL PLANT LAY-OUT

*on*

### LARGE NEW CONTRACTS

There are vacancies in the Stockport, Manchester, and Mayfair offices. Salaries, working conditions, and prospects are (we believe) very good. Apply to Staff & Training Division (Ref. VR 42), Simon-Carves, Ltd., Cheadle Heath, Stockport, Cheshire.

## MISCELLANEOUS ADVERTISEMENTS.

*Situations Wanted, 3d. a word: minimum 7s. 6d. Situations Vacant, 4d. a word: minimum 10s. Other miscellaneous advertisements, 4d. a word: 10s. minimum. Box number 1s. extra. The engagement of persons answering these advertisements is subject to the Notification of Vacancies Order, 1952.*

**Advertisements must reach this office by the 23rd of the month preceding publication.**

## SITUATIONS VACANT.

**SITUATIONS VACANT.** THE TRUSSED CONCRETE STEEL CO., LTD., Truscon House, 35-41 Lower Marsh, London, S.E.1, have vacancies in their London, Birmingham, Glasgow, and Manchester offices for designers and designer-draftsmen with considerable experience in reinforced concrete D.O. work. Five days' week and pension scheme. Apply in writing to the above address, giving full particulars of age, education and previous employment.

**SITUATIONS VACANT.** Reinforced concrete engineers require designer-draftsmen, preferably A.M.I.Struct.E., for work at Bristol or near London. Opportunity to widen experience. Good salary to right men. Box 3648, CONCRETE AND CONSTRUCTIONAL ENGINEERING, 14 Dartmouth Street, London, S.W.1.

**SITUATION VACANT.** THE TRUSSED CONCRETE STEEL CO., LTD., Truscon House, 35-41 Lower Marsh, London, S.E.1, have a vacancy in their London office for a measurer with experience in the taking-off and preparation of bills of quantities mainly for reinforced concrete structures. Age 25-30. Five days' week and pension scheme. Apply in writing to the above address, giving full particulars of age, education, and previous employment.

**SITUATION VACANT.** Consulting structural engineer, Westminster, requires senior designer-draftsman with first class experience in reinforced concrete for responsible position. Experience in structural steel work an advantage. High salary and good prospects for suitable applicant. Write in confidence, stating age, qualifications, and full details of experience. Box 3651, CONCRETE AND CONSTRUCTIONAL ENGINEERING, 14 Dartmouth Street, London, S.W.1.

**SITUATIONS VACANT.** Consulting engineers require several designer-draftsmen with about 2-3 years' experience in reinforced concrete work. Salary in accordance with qualifications and experience. Applicants should be graduates of either the Institution of Civil or Structural Engineers. Apply in writing to ANDREWS, KENT & STONE, 60-66 Wardour Street, London, W.1.

**SITUATION VACANT.** Experienced reinforced concrete designer required for work in the project section of a firm of reinforced concrete engineers and contractors. Write, giving full details of past experience, and qualifications. Five days' week. Applications will be treated in confidence. Box C.E.203, 191 Gresham House, London, E.C.2.

**SITUATION VACANT.** Senior structural engineer, A.M.I.C.E., wanted by well-known firm of contractors and engineers for their London drawing office. Considerable experience of reinforced concrete essential. Box 3652, CONCRETE AND CONSTRUCTIONAL ENGINEERING, 14 Dartmouth Street, London, S.W.1.

**SITUATIONS VACANT.** Orlit, Ltd., require technical representatives to cover London and Home Counties. Knowledge of precast and reinforced concrete an advantage. Contacts among architects, County and Local Authorities essential. Good salary, commission, and expenses. Car provided. Write, giving full particulars of personal background, age, and experience, to SALES MANAGER, ORLIT, LTD., Colnbrook By-Pass, Bucks.

**SITUATION VACANT.** Civil engineering assistant, capable of designing and detailing reinforced concrete structures, required by Edinburgh firm of consulting engineers. Details of qualifications, experience, and salary required to Box 3653, CONCRETE AND CONSTRUCTIONAL ENGINEERING, 14 Dartmouth Street, London, S.W.1.

**SITUATION VACANT.** Sales manager required by well-known company manufacturing concrete products. Preferably under 35 years of age, and with comprehensive knowledge of sales organisation, administration, and modern methods. Ability to control and direct representatives and initiate sales promotion schemes. Applicants must have a first-class knowledge of concrete products, including cast stone and patented concrete floor beams—this qualification is essential, and no others need apply. Applications are invited in confidence, with details of age, experience, references, and salaries received. Box 3654, CONCRETE AND CONSTRUCTIONAL ENGINEERING, 14 Dartmouth Street, London, S.W.1.

**SITUATION VACANT.** Reinforced concrete detailer-draftsman required for progressive position with consulting engineer in Victoria Street, London, S.W.1. State training, experience, and salary required. 3 days' week, and pension scheme. Box 3655, CONCRETE AND CONSTRUCTIONAL ENGINEERING, 14 Dartmouth Street, London, S.W.1.

**SITUATION VACANT.** Old-established Tees-side firm requires section leader reinforced concrete designer-draftsman, fully experienced in designing and detailing reinforced concrete structures, foundations, and other civil work. Apply, giving full particulars and experience, quoting reference D, to Box No. 3656, CONCRETE AND CONSTRUCTIONAL ENGINEERING, 14 Dartmouth Street, London, S.W.1.

**SITUATIONS VACANT.** Young site engineers required by contractors. Graduates preferred. Some knowledge of setting-out and measuring essential. Apply J. L. KIER & CO., LTD., 7 Lygon Place, Westminster, S.W.1.

**SITUATION VACANT.** The Stanton Ironworks Company Limited, near Nottingham, has a vacancy for a representative in London and the South in connection with the sale of its concrete products. Applicants should have some technical knowledge, and be accustomed to interviewing at a high level. The appointment is superannuated. Write in confidence, with full details of qualifications and experience, to the STAFFING OFFICER.

**SITUATION VACANT.** Qualified structural or civil engineer experienced in the design and development of both prestressed and reinforced precast concrete. Apply, with details of education, experience, and salary required, to the MANAGING DIRECTOR, THE CROFT GRANITE, BRICK & CONCRETE CO., LTD., Croft, Leicester.

**SITUATION VACANT.** Assistant works manager required by precast concrete manufacturers in Surrey and within 20 miles of London. Applicants should have first-class knowledge of precast concrete and allied trades. Excellent opportunity for man with ability and initiative. Salary by arrangement. Box 3657, CONCRETE AND CONSTRUCTIONAL ENGINEERING, 14 Dartmouth Street, London, S.W.1.

**SITUATIONS VACANT.** Civil engineering draughtsmen (2) required by Westminster consultant. Age range preferred, 23-30. H.N.C. studies advantageous. Remuneration arranged according to experience. Position carries staff pension. Box 3658, CONCRETE AND CONSTRUCTIONAL ENGINEERING, 14 Dartmouth Street, London, S.W.1.

**SITUATIONS VACANT.** Required by large firm of civil engineering contractors for work in the firm's head office in London. (1) Engineers, age 26-30, degree and/or Corporate membership of the Institution of Civil or Structural Engineers; some years' design office experience and preferably some field experience. (2) Junior engineers, degree and an interest in general design work. Experience not necessarily required. Duties will consist mainly of design work in connection with existing contracts and tenders. Salary by arrangement. Apply, giving relevant details, to Box 3659, CONCRETE AND CONSTRUCTIONAL ENGINEERING, 14 Dartmouth Street, London, S.W.1.

**SITUATION VACANT.** Civil Engineer, with degree or professional qualifications, required as project engineer by civil engineering contractors operating overseas. Duties include negotiations with clients, putting forward alternative schemes if considered advantageous, control of design and drawing office and concrete and soil mechanics laboratory, the handling of estimates and tenders, etc. This is a senior appointment and only applicants with first-rate engineering background will be considered. Write, with full particulars, to Box M.964, c/o STREETS, 110 Old Broad Street, London, E.C.2.

(Continued on p. 185.)

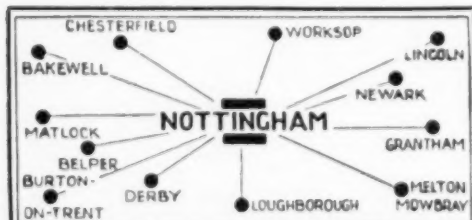
(Continued from p. 18v.)

**SITUATION VACANT.** A Company specialising in the design of reinforced concrete buildings requires an engineer for site inspection of work carried out by contractors to the Company's designs. Applicants should have held responsible positions as resident engineers or agents for reinforced concrete constructional work. Visits to sites in all parts of the country will be entailed. Some design experience is desirable. Write, giving details of age, experience, and salary required, to Box C.E.236, 191 Gresham House, London, E.C.2.

**SITUATIONS VACANT. NORTH THAMES GAS BOARD.** The following Drawing Office staff are required in the Chief Engineer's Department. (i) At Becton, E.6, Lea Bridge, E.10, Mill Hill, N.W.7, and Kensal Green, W.10—Draftsmen experienced in the maintenance of gas manufacturing and ancillary plant. Starting salary within the range £170-£200 per annum. (ii) At Westminster, S.W.1—(a) Senior Draftsmen experienced in the design of gas manufacturing and ancillary plant, including steel frame structures. Starting salary within the range £145-£175 per annum. (b) Draftsmen experienced in the layout and detailing of gas manufacturing and ancillary plant, including steel frame structures. Starting salary within the range £120-£145 per annum. (c) Draftsmen for detailing reinforced concrete structures. Experience in design would be an added advantage. Starting salary within the range £120-£145 per annum. All these appointments are of a permanent nature, and successful candidates will be required to join the staff pension scheme. Starting salaries within the ranges mentioned will be dependent on age and qualifications. Applications, giving full particulars, should be sent to the STAFF CONTROLLER, NORTH THAMES GAS BOARD, 30 Kensington Church Street, London, W.8, to reach him not later than ten days after the publication of this advertisement, and quoting reference 666, 61.

**SITUATIONS VACANT.** Designer-detailers required by consulting engineers for their Newcastle-upon-Tyne office. Applicants should have had previous experience of heavy reinforced concrete industrial foundations, structures, and other civil engineering works. Appointments offer chances to secure sound and extensive experience, and will carry good salaries and prospects according to experience and ability. Apply, giving full particulars of qualifications, training, and experience, together with a statement as to salary required, to Box 3645, CONCRETE AND CONSTRUCTIONAL ENGINEERING, 14 Dartmouth Street, London, S.W.1.

**SITUATION VACANT.** Required. Fully experienced reinforced concrete designer for light frame structures and hollow-tile construction. Pension scheme in operation. Every alternate Saturday. Salary £750 upwards, according to experience. Box 3661, CONCRETE AND CONSTRUCTIONAL ENGINEERING, 14 Dartmouth Street, London, S.W.1.



**Trent Gravels**  
**10,000 tons per week**  
 Washed & Crushed  $1\frac{1}{2}$  in. to  $\frac{1}{4}$  in.

We are the leading suppliers of high-class concrete aggregates in the area shown above. Prompt deliveries guaranteed and keen competitive prices quoted. Send for samples and prices.

**TRENT GRAVELS LTD**

**ATTENBOROUGH** **NOTTS**  
 Telephone: Beeston 54255.

**SITUATION VACANT.** Designer-detailer (reinforced concrete) required by consulting engineers in London. Salary, from £600 upwards, to be agreed according to experience and qualifications. Post is progressive as regards both position and remuneration. Box 3662, CONCRETE AND CONSTRUCTIONAL ENGINEERING, 14 Dartmouth Street, London, S.W.1.

**SITUATION VACANT.** Civil engineering draughtsman required for design and detailing of reinforced concrete structures and foundations, steel structures, and brick buildings in connection with heavy engineering and chemical industry. Applicants should have relevant academic qualifications up to at least N.C. standard and sufficient experience to enable them to prepare drawings from verbal and briefly-sketched instructions. A knowledge of site surveying and levelling is also necessary. Write for application form to PERSONNEL MANAGER, IMPERIAL SMELTING CORPORATION, LTD., Avonmouth, Bristol, quoting reference CD/CCE.

**SITUATION VACANT.** Required for consulting engineer's office, experienced detailer for reinforced concrete work. Good drawing-office experience essential. Apply in writing, giving age, experience, and salary required, to F. J. SAMUELY, 8 Hamilton Place, London, W.1.

**SITUATIONS VACANT.** The British Reinforced Concrete Engineering Co., Ltd., require several qualified designers and detailers with specialist experience for their Stafford, Bristol, Glasgow, London, Newcastle-upon-Tyne, and Dublin offices. Five days' week and staff pension scheme. Apply to B.R.C. ENGINEERING CO., LTD., Stafford.

### PROFESSIONAL SERVICES.

**PROFESSIONAL SERVICES.** Qualified experienced engineer offers his services in preparing complete reinforced concrete designs, or preparation of schedules from detailed drawings. All jobs, large or small, undertaken. Moderate rates. Box 3690, CONCRETE AND CONSTRUCTIONAL ENGINEERING, 14 Dartmouth Street, London, S.W.1.

### PATENT.

**PATENT.** Patent No. 613,801, "Ceramic elements for flooring beams, and joists," for sale or licence. For details apply CHATWIN AND COMPANY, 253 Gray's Inn Road, London, W.C.1.

### FOR SALE.

## REINFORCING RODS

For Sale with prompt delivery,  $\frac{1}{2}$  in. diameter by any length at £28 per ton.  $\frac{1}{4}$  in. diameter by 18 ft. at £32 per ton. Regular tonnage produced by

**A. BIRCHALL LTD.**  
 23 Farrar Lane, Leeds, 6

**FOR SALE.** Sacks, bags, and curing cloths for sale. You want the best type and quickest delivery. Write JOHN BRAYDON, LTD., 26 The Highway, London, E.1. Telephone: ROYal 1044.

**FOR SALE.** Flat enamelled steel plates, 14 in. by 12 in. by  $\frac{1}{8}$  in., drilled fitting holes. 50 at 4s. 6d. each. 100 at 4s. each. Ex works. E. STEPHENS & SONS, LTD., Bath Street, London, E.C.1.

**FOR SALE.** Steel gutters and ironwork. Keen prices and delivery. E. STEPHENS & SONS, LTD., Bath Street, London, E.C.1.

**FOR SALE.** Steel moulds and special shuttering to requirements. E. STEPHENS & SONS, LTD., Bath Street, London, E.C.1.

### FOR HIRE.

**FOR HIRE.** Lattice steel erection masts (light and heavy), 30 ft. to 150 ft. high, for immediate hire. BELLMAN'S, Terminal House, London, S.W.1. Telephone: Sloane 5359.

### WANTED.

**WANTED.** Concrete sill machine—liner, Kirk, or similar. Joists, Contractor, Coleford, Bath.



**ALPHA CEMENT LTD**

**PORTLAND HOUSE TOTHILL STREET**

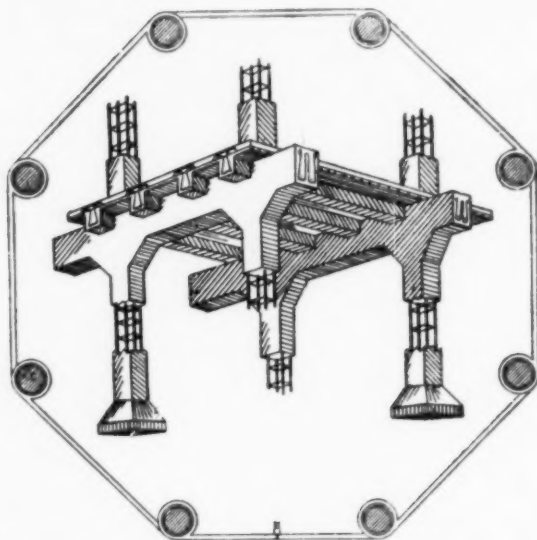
**LONDON, S.W.1.**

*Telephone - Abbey 3456.*



# FRED MITCHELL & SON LIMITED

*Building & Civil Engineering Contractors*



*Bridge, Road and Rail Construction,  
Cooling Towers, Silos & Commercial Buildings,  
Excavations, Foundations, Piling,  
Dock and Sea Defence Work,  
Water Mains, Sewerage, Reservoirs etc.*

**RIVER PLACE · CITY ROAD · MANCHESTER**

*Telephone: Central 7018-9*